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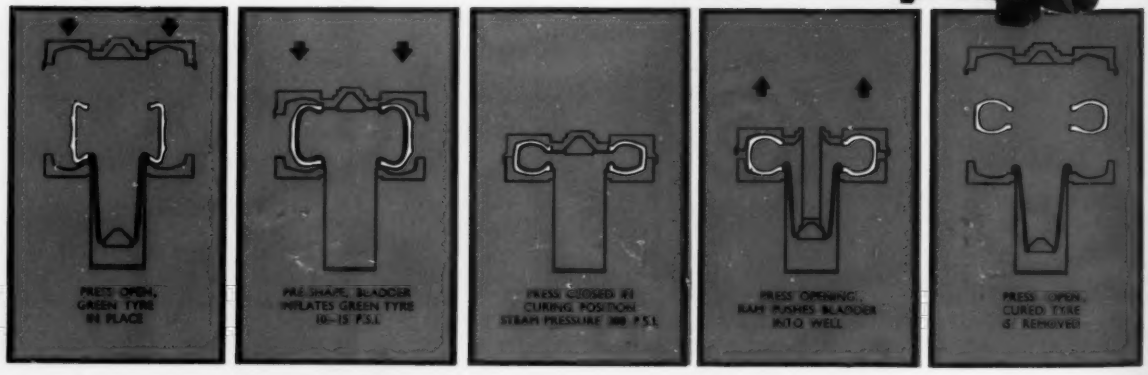
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IN ITS 75th YEAR

May 23 1959

Editorial

NOTES OF THE WEEK 771

Articles and News

A SURVEY OF POLYMERS 773
SOVIET RUBBER TECHNOLOGY 776
RUBBER TECHNOLOGY 777
FACTICE-COMPENSATED ACCELERATION OF SBR ... 780
DU PONT UK LABORATORY 794
INTERNATIONAL PLASTICS EXHIBITION 795
DSIR ANNUAL REPORT 796
BTR LONG SERVICE AWARDS 798

Features

NEWS BRIEFS 772
VIEWS AND REVIEWS 786
QUESTIONS CORNER 788
MEN AND MATTERS 790
RUBBER CROP RETURNS 798
COMPANIES IN THE NEWS 799
RUBBER STATISTICS 800
PATENT SPECIFICATIONS 801
RUBBER MARKETS 802
INDUSTRY INTELLIGENCE 803
TRADE MARKS 804

Classified Advertisements . . . 805 **Advertisers Index . . . 808**

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NOTES of the WEEK

Soviet Rubber Technology

THIS month sees the publication of a new technical journal of major importance to the Rubber industry. Entitled *Soviet Rubber Technology*, the new journal is a translation of the leading Russian rubber periodical *Kauchuk i Rezina*. The emergence of the USSR not only as a first class scientific power but also as an increasing source of original technical literature has posed a serious problem to the Western world. Reports have it that a very considerable proportion of Russian scientists can read English; unfortunately, the reverse is not the case. It has been evident for some time that Russian rubber research and technology, in particular, is both extensive and well advanced. It follows, therefore, that it is of great importance that our rubber industry should keep in touch with Russian developments and, to this end, *Soviet Rubber Technology* should prove of the utmost value. The new journal is a monthly cover-to-cover translation prepared by the Research Association of British Rubber Manufacturers under the auspices of DSIR Translation Unit. The editor and translator, Mr M. Lambert, is on the staff of RABRM. Dr J. R. Scott, former RABRM research director who originated the negotiations with DSIR, is associated with the work as technical adviser and Maclaren and Sons Ltd., publishers of *RJIP*, are responsible for production and distribution. Dr W. F. Watson, director of research, RABRM, contributes a foreword to the first number. Details of subscription rates to *Soviet Rubber Technology* are reported elsewhere in this issue.

US Rubber Stockpile

REPORTS of possible releases of rubber from the US stockpile, without subsequent replacement, have caused a certain amount of confusion in rubber markets. Basic cause of this was the recent statement by the US House Appropriations Committee ordering the administration to stop replacing stockpile materials it must rotate to prevent deterioration. Some clarification of the position has followed from a statement by a spokesman for the General Services Administration that the House Appropriation Committee recommendation must now go to the Senate for action and then back to the full House of Representatives if the recommendation is acceded to by the Senate. It is understood that until June 30, the GSA has the funds to continue its policy of rotation of rubber, and other items, in the stockpile. Later reports have it that Federal Government officials consider it likely to be at least two years before natural rubber is sold from the stockpile. At private hearings last month GSA officials told the house committee that it was taking 55,000 long tons of natural rubber in the 1959 fiscal year and planned to rotate 40,000 tons in the 1960 fiscal year. As noted last week in *RJIP*, the present rubber stockpile is estimated to have cost about $800m. Further comment on the position came from *The Wall Street Journal* on Monday to the effect that the recent weakness in the price of rubber spotlighted the importance and risks of the huge stockpile. The newspaper noted that ' if the Government tried to sell in the open market the 39 materials of which it had too much, it would drive down the prices of many of them.' This, of course, would be inevitable. But it is clear that the underlying demand for rubber remains good and it seems not unlikely that the House Appropriations Committee recommendation was made with an eye on the present rubber market.

PI Associateship

WHEN, in March last, on the occasion of the chairman's lecture to the London Section of the Plastics Institute, the question of qualifications for associate membership of the Institute was raised, Mr Dennis Mahon was able to state that the Institute was even then considering the matter and that details would shortly be published. Last week, the Council of the Institute announced revised regulations which go far to meet earlier criticisms to the effect that there were many on the fringe of the plastics industry who had qualifications which should entitle them to associate membership without taking the rather formidable examination syllabus. This sensible move will, undoubtedly, bring considerable mutual advantages.

Tour of Value

A VERY successful tour of Midlands and North Wales Rubber factories was recently undertaken by students of the National College of Rubber Technology. The value to the students—and to the industry—of such visits is clearly immense for in no other way could the students have seen so much in so short a time and at so little expense, both to themselves and to the Ministry of Education which bore the major part of the expense. The students, most of whom had never been inside a rubber factory before, saw almost every major process of rubber manufacture as well as rubber reclaiming and the moulding and extrusion of a wide range of plastics.

NEWS *Briefs*

MALAYAN IMPORTS — RUSTYFA IN BUCHAREST
ESTONIAN CHEMICAL PLANT — RUSSIAN VISIT
RUBBER STOCKPILING — KAZAK SR FACTORY

●**Malaya** — A warning that Communist nations might be stockpiling rubber in order to dump it on world markets at some future date was given in Ipoh over last weekend by a leading Malayan planter. Mr J. E. S. Crawford, immediate past president of the United Planting Association, was commenting on the recent rise in natural rubber prices and increased Communist buying. He told reporters: 'What the Communists did to the tin market just over a year ago they may do in the rubber market and create a rubber depression. They are capable of such acts.'

●**Sweden** — Sweden could become the biggest export customer of the International Synthetic Rubber Co., of Southampton. This was stated at a Press conference in Stockholm by Mr H. J. Hornsby, the company sales manager, who has been visiting prospective customers in Sweden. Of the company's yearly production of 70,000 tons, 50,000 tons went to the United Kingdom market, the rest being exported mainly to Commonwealth countries and to Scandinavia. Of Sweden's yearly consumption of 25,000 tons of rubber, 7,000 tons were synthetic. The synthetic rubber was currently mainly imported from the United States.

●**Russia**—Commenting on his visit to the USSR during the first stage of his 35,000-mile round-the-world business tour Mr R. E. G. Windsor, managing director of R. H. Windsor, said that the Russian Government had requested his company to design a complete factory for the manufacture of high- and low-pressure polythene piping and rigid PVC.

●**Indonesia**—A tyre factory ordered from Czechoslovakia in April 1957 has been opened officially in Djakarta by the Acting President, Mr Sartone. Mr Sujono, the manager of the factory, said the factory would produce 250,000 sets of tyres for jeeps and trucks annually.

●**Israel**—Alliance Tire and Rubber Company plans to double the production capacity of its plant at Hadera. Announcing this, the firm's President, Mr A. Taubman, said an additional investment of between two and 2.5m. dollars would enable the plant to expand its annual capacity to 7,500 tons of rubber products soon. Rubber product output at the plant totalled 4,200 tons last year.

●**Rumania**—A delegation of representatives of Rustyfa Ltd., at present in Bucharest, is negotiating a contract to build a complete tyre factory worth about £7m.

●**Malaya** — Malayan estate workers will get higher wages if the price of rubber stays above one Straits dollar in the next week. A new wage agreement for plantation workers coming into force on June 1 is based on the average price of rubber between April 21 and May 20. Besides a guaranteed wage, tappers are to receive extra payments based on the amount of latex they collect.

●**Estonia**—A very large chemical plant, to be built in Estonia, will get its raw materials from the local shale deposits, estimated at many millions of tons. The plant, which will produce nitrogenous fertilizers and chemical raw materials for the north-west of the USSR, will become the basis for the production of synthetic rubber, artificial fibres and other products. A new technique will be used in the chemical treatment of shale. With the present equipment, refining takes a number of hours, whereas by using the new technique it will be done in practically the same number of minutes. Moreover, this process makes it possible to carry out a drastic reduction in the overall dimensions of the equipment. All the products obtained from the chemical treatment of oil, natural gas and coke, can also be got from shale.

●**Kazak**—A plant producing synthetic rubber—the first of its kind in Kazak—will go into operation this year in Temir Tau, near the Karaganda metallurgical works. The plant will process the gases and liquid products of the coking department of the metallurgical works, the products of oil refineries and, later on, combustible gases from the Urals-Embinsk basin. Departments of the plant, which are already in operation, are producing calcium carbide, acetic acid and other chemicals in large quantities.

●**Malaya**—Imports of foreign rubber into Singapore and the Federation of Malaya during April amounted to 38,155 tons as shown by final documents received, according to preliminary figures issued by the Chief Statistician in Singapore. This figure includes 23,879 tons imported on provisional permits in previous months for which final documents have been received and excludes approximately 15,209 tons imported during the month for which final documents have not yet been received.

'Comrade] Nokusoffski wishes me to say that he hopes the penalty clause never has to be enforced on these tyre plant contracts' — 440

A Survey of Polymers

OCCA CONFERENCE

OVER 400 delegates attended the conference of the Oil and Colour Chemists Association at Edinburgh on May 5 to 9. With the title, 'A Survey of Polymers' the conference consisted of nine lectures. Under the chairmanship of Professor E. L. Hurst, the first group of lectures dealt with the future of polymers; fluorine, phosphorus and boron were selected for consideration.

Fluorine compounds

In the first lecture on 'Fluorine Compounds,' Dr R. E. Banks stressed the fact that fluorine was one of the commonest elements; it was actually more abundant on the earth's surface than chlorine. The work of the US Atomic Energy authorities had given a powerful impetus to its further development. The large fluorine atom, he said, had a powerful shielding effect on the other atoms in a fluorine containing polymer and thus caused profound modifications in the properties of these resins. Whilst fluorine chemistry had expanded in recent years, there was still lacking a satisfactory epoxide polymer containing fluorine, and also a good clear type resembling Perspex.

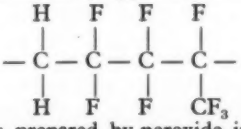
Polymers containing Fluorine

'Polymers Containing Fluorine' were next discussed in a paper by R. E. Banks and R. N. Haszeldine. The authors pointed out that the characteristic properties of synthetic high polymers containing fluorine were: Outstanding heat resistance; chemical inertness; excellent electrical insulation and dielectric; good mechanical characteristics; unaffected by weathering; water repellancy; low coefficient of friction; non flammability; high density. Most fluoropolymers were prepared by addition polymerization. The easiest monomers to prepare of current importance were tetrafluoroethylene, chlorotrifluoroethylene, vinylidene fluoride, vinyl fluoride and hexafluoropropylene. As examples, vinyl fluoride was prepared by the catalytic addition of HF to acetylene, and C_2F_4 by pyrolysis of chlorodifluoromethane (Freon 22). Polymerization was by conventional methods, *e.g.*, using ammonium persulphate.

Polytetrafluoroethylene had a working range of –80°C to 300°C, and, as thin flexible film, could be used at liquid nitrogen temperature. Toxic decomposition products were formed over 400°C. Within working range PTFE was attacked only by molten sodium or potassium. Mechanically it was harder and less flexible than polythene, and it was not resilient. Mechanical strength was fair, and impact strength high, but resistance to deformation under load was poor. The coefficient of friction was extremely low (0.04) and independent of temperature. The resin had no melt stage, but at the transition point (327°C) it changed to an amorphous transparent gel. Sintering was used as a fabrication technique.

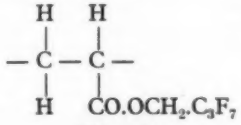
Aqueous emulsions existed, stabilized with non-ionic surfactants, and the resins from these showed slightly more typical thermoplastic resin properties. Special techniques had been developed for giving adhesion of PTFE to itself and other polymers such as etching the surface with a sodium complex in solvent. Polytrifluoroethylene in general showed less extreme properties than PTFE. Thus it had a melt stage above 216°C, and could undergo compression and transfer moulding. Other fluorine type polymers such as polyvinyl fluoride and polyvinylidene fluoride were being developed.

In addition to the above a number of copolymers had been developed which had the properties of elastomers. They had been developed for use in aircraft under extreme conditions. The copolymer of vinyledine fluoride and hexafluoropropylene (Viton A)—



—was prepared by peroxide initiated copolymerization at 100°C. The methylene groups introduced flexibility into the molecule, and sites for cross-linking reactions. The temperature range was –44°C to 315°C, and processing in standard equipment was possible. Unvulcanized Viton A was ketone soluble, but had poor resistance to diester and phosphate ester hydraulic fluids.

Other elastomers based on fluorinated hydrocarbons included Fluororubber 1F4 (1 : 1 dihydroheptafluorbutyl acrylate), and fluoro-rubber 2F4 (as below) which gave better low temperature flexibility.



1F4 unit

2F4 unit

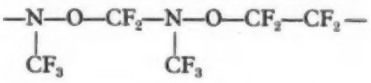
Both had resistance to diester lubricants.

A polyester fluoropolymer with unit as follows was easily hydrolyzed, but could be used as aircraft tank sealant:

$$-O.CH_2.(CF_2)_3.CH_2.O.CO.(CH_2)_4.CO-$$

Some fluorosilicone rubbers were now under development.

Future work on fluorinated polymers would, to a large extent, be concentrated on obtaining cheaper sources of monomers to avoid prices which ranged from £2 to £8 per lb. as at present. Other monomers such as fluorinated styrenes were being investigated, but it must be remembered that fluorination caused profound reactivity changes. Thus perfluorbutadiene did not homopolymerize. Perfluoroalkyl nitrose compound yielded semiorganic 1 : 1 copolymers with olefines, *e.g.* tetrafluoroethylene,



Organo-phosphorus Polymers

'Organo - phosphorus Polymers' were discussed in a paper by A. F. Childs and H. Coates.

Dr Childs stressed that the unshared pair of electrons which was characteristic of tervalent phosphorus dominated its chemistry in respect of resin formation. The somewhat toxic nature of this group was in contrast to phosphorus compounds of traditional valency of five, and had slightly mitigated against its use. This unshared pair of electrons readily co-ordinated, and thus there was a strong tendency to form the phosphoryl (P=O) group wherever possible, and there was a great tendency for 3-co-ordinate compounds containing singly bound oxygen to isomerize to 4-co-ordinate phosphoryl derivatives.

Polymers of most of the main classes of synthetic resins were known, although none had yet reached great industrial significance. Most were of the mixed organic/inorganic type, relying upon carbon or ester backbone chains. Resins with a phosphorus backbone were rare. One of the general disadvantages of phosphorus

containing resins was a tendency to hydrolyze. The main interest was in flame and flare resistance which made some textile applications of interest.

Both allyl and vinyl types of addition polymers had been prepared of which the former seemed the most promising, diallyl phenylphosphonate being the most individually promising monomer giving hard clear films, a high distortion point and an r.i. similar to glass. Vinyl types polymerized much less readily, although some anomalous results reported seemed to be due to inhibitory effect of trialkyl phosphites present as impurities.

Condensation polymers of the polyester type had been well known since the first patent by Arvin in 1936. This type was based on the reaction between phosphoryl chloride and a polyhydric phenol such as diphenylolpropane. Modified resins had been prepared with phosphonic chlorides ($RPOCL_2$), aryl phosphochloridates ($ROPOCL_2$), etc.

Formation of a direct carbon-phosphorus bond resulted in a link which was not easily hydrolyzed or oxidized. A number of methods had been developed for forming this link such as the Arbuzoy Reaction $(RO)_3P + R'X \leftarrow R'PO(OR)_2 + RX$ (R=aryl, alkaryl), and a Friedel-Crafts type—

$$ArH + PCl_3 \xrightarrow{AlCl_3} RPOCl_2 + HCl$$

Other methods had also been developed.

This type of product included polyesters and amides recently introduced by Korshak, V. V. (*J. Polymer Sci.*, 1958, **31**, 319)—

$$(-COC_6H_4\underset{\displaystyle Ph}{\underset{|}{P}}(O)C_6H_4COO(CH_2)_2O-)_n$$

The addition of phosphorus into the main chain actually increased chain flexibility, and softening points of these phosphorus compounds were lower than corresponding carbon compounds.

Phosphorus polyamides were known using phosphonic acid diamides as a starting product, but they were rather easily hydrolyzed. A complex product was formed by reacting polyvinyl alcohol with diethylphosphochloridate, and thence with an aromatic diisocyanate, which liberated active isocyanate groups on heating. Dialkylepoxyalkylphosphonates—

$$(CH_2\overset{O}{\diagup\diagdown}CH-CH_2PO(OR)_2)$$

and allied products were known which gave flame resistant materials suitable for potting or coating.

Tetrakis (hydroxymethyl) phosphonium chloride (THPC) $[(HOCH_2)_4P]^+Cl^-$ was formed by reacting phosphine with formaldehyde in presence of conc. HCl, and condensed with substances containing active hydrogen.

Efforts had been made to obtain polymers with a direct phosphorus-carbon methylenic link, so far with limited success. Polymers, entirely or partly inorganic, based on the phosphonitrilic skeleton $-P=N-$ were receiving attention, and the work of K. A. Adrianov and A. A. Zhdanov (*J. Polymer Sci.*, 1958, **30**, 513), who had made a general study of polymers containing an inorganic backbone, showed that they were rendered less brittle and more solvent soluble by surrounding organic radicals.

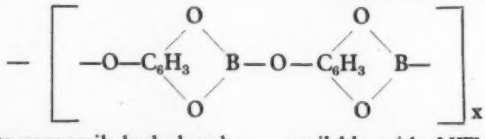
Boron Polymers

A paper on 'Experimental Approach to the Production of Applicable Boron Polymers,' by W. Gerard, was the next to be delivered. There were only a few scattered references to successful polymers containing boron in spite of much experimental work. Patents by Upson (US 2511310, 2517944, 2517945, 2599144) dealt with production of boronamide polymers by interaction of boronic acid and a bifunctional isocyanate.

$$-[-\underset{\displaystyle Ph}{\underset{|}{B}}-\underset{\displaystyle H}{\underset{|}{N}}-C_7H_6-\underset{\displaystyle H}{\underset{|}{N}}-].$$

Details of properties and stability were still lacking. In general it was suitable polymer units which were still being sought, the linkages of which would be harnessed for polymerization.

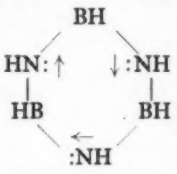
The chemistry of boron was, however, very unpredictable, and was dominated by a tendency to ring formation. Most experimental work still belonged to the field of organic rather than polymer chemistry. A number of miscellaneous viscous materials had been obtained by reacting glycol with boric acid, and also substituted ureas with boric acid. They were all water sensitive. Some resins had also been claimed using dihydroxy phenols, and a short chain polymer of pyrogallol and BCl_3 was mentioned—



All products were easily hydrolyzed.

Some efforts had been made to prepare fundamental compounds which would be less liable to hydrolysis. Thus the dibutyl or diphenyl boronic esters of the enol form of ethylacetoacetate were stable to hydrolysis, presumably due to chelation, whilst 2-chloro vinyl boronic acid ($Cl-CHB=(OH)_2$), 2 : 2 dimethyl vinyl boronic acid and phenyl boronic acid were more resistant to oxidation than alkyl boronic acids, this being ascribed to the filling of the valency shell of boron by the electrons of the adjacent double bond or ring.

Most modern work was based on the preparation of substituted borazoles (Rutgers : Gerard), borazole



being an entirely inorganic ring with some structural resemblance to benzene. There was some evidence that polymers had been formed by the action of 2-chlorvinylboron dichloride (formed catalytically from C_2H_2 and BCl_3), but results were not properly sorted out. Potentialities in the borazole system produced possibilities for condensation reactions, such as the reaction between p-phenylene-diamine and p-phenylene-bis-boron dichloride ($Cl_2BC_6H_4BCl_2$).

Some investigations had been made by Burg (US) and by Gerard on polymers containing boron-phosphorus links. Whilst the chemistry of these systems had been developed considerably, no commercial polymers had as yet been elucidated.

Polysulfides and Coatings

'Polysulfides and Coatings' were discussed next by W. H. Stevens. Sulfide containing elastomers had been marketed for many years under the trade name of Thiokols. Whilst original type was formed by condensation of ethylene dichloride with sodium polysulfide, other dichlorides such as dichlooethyl formal, and glycerol dichlorhydrin, including mixtures, were now utilized. Mercaptan type softeners were required where necessary instead of the conventional plasticizers. Whilst aqueous products contained particles of 2-6 microns, they were not latices.

A series of liquid products was now available with MW from about 500 to 1,400, and were amber liquids of varying viscosities. Low molecular weight polymers were in general compatible with ethoxyline resins. All types of Thiokols could be cured, either by zinc oxide, or by the use of a

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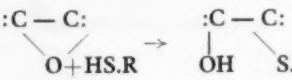
peroxide, and a small amount of trihalide could be included in the polymer to obtain limited cross linking on curing.

Discussing applications, the author said that apart from straight pigmented coatings, polysulfides had a number of applications in conjunction with other resins of which combinations with ethoxyline (epoxide) resins were the most interesting, and which probably reacted by a mechanism such as:



These blends were particularly interesting for electrical applications, and a blend of 3 parts polysulphide : 1 ethoxyline resin had a very low shrinkage value on cure. A general application of considerable interest was as a sealant, especially for constructional purposes, advantages being fluid form, ease of application, excellent *in situ* properties such as weathering, easy repair, and oil and fuel resistance.

In reply to a question, the speaker indicated that a lead peroxide curing agent gave the best water resistance.

(To be concluded)

'Soviet Rubber Technology'

A NEW PUBLISHING VENTURE

A NEW monthly periodical for the rubber industry appeared this week. Produced by the Research Association of British Rubber Manufacturers in collaboration with Maclaren and Sons Ltd., proprietors of *RŽIP*, 'Soviet Rubber Technology' is a cover-to-cover translation of the well-known Russian technical journal 'Kauchuk i Rezina.'

'Soviet Rubber Technology' is one of a number of translations of Russian technical journals being produced in this country under the auspices of the DSIR Translations Unit. It is being translated by Mr M. Lambert, B.A., who has been specially engaged by RABRM for this task, and Dr J. R. Scott is acting as editorial advisor on the scientific aspects of the work.

The first issue to appear dated June, is a translation of the January issue of 'Kauchuk i Rezina,' and is being sent free of charge to all members of RABRM and subscribers to *RŽIP*. Any reader of *RŽIP* who receives his weekly copy through a newsagent, will be sent a copy of this first issue on application to Maclaren and Sons Ltd., 131 Great Suffolk Street, London, S.E.1.

Among the contents of the first two issues of 'Soviet Rubber Technology' are the following articles: Synthesis and use of carboxylated latices for impregnating tyre cord; Electro-deposition of carboxylated latices; (1) Obtaining films of carboxylated latices on fabric by means of electro-deposition; Preventing scorching in rubber stocks by using benzoates; Carbon black structures and the tear resistance of vulcanizates; Creep of rubbers at high temperatures; Stock-preparation department at the Dnepropetrovsk tyre works; Effect of the temperature at which butadiene is polymerized with alkali metals on the structure and cold-resistance of the polymer; New high-pressure rapid mixers; Method of measuring the thickness of latex films; Determining the chlorine and bromine content of raw and vulcanized rubbers by combustion; Manufacturing hose without using mandrels; Estimating the degree of vulcanization of latex films by their swelling; and articles on economic, business, and productivity problems, making the publication of interest to all members of the industry.

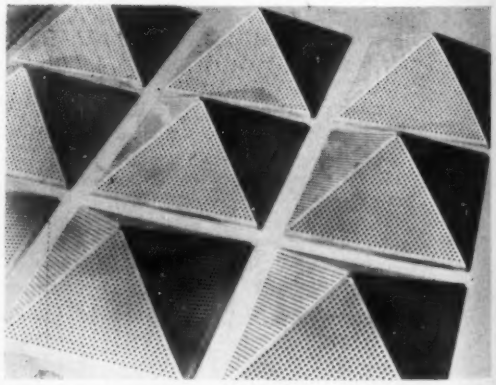
The annual subscription is £10 10s. (£5 5s. to members of RABRM) and $50 or equivalent abroad. The DSIR has undertaken to reimburse the Research Association for the salary of the translators, overheads, and production costs. If the subscription income exceeds total costs, largely met by the Department's subsidy, the effort will be run at a financial profit to RABRM.

W. T. GLOVER & CO LTD RETIREMENT

MR. NORMAN DIXON, A.M.C.T., A.R.I.C., F.I.R.I., for many years chief chemist and later technical manager, rubber and plastic division of W. T. Glover and Co. Ltd., Trafford Park, Manchester, has retired. He completed 50 years service with the company on December 31, 1958. To mark his retirement the directors arranged a dinner at the Normandy Hotel, Knightsbridge, at which Mr D. T. Hollingsworth, director and general manager, presented Mr Dixon with a gold wristwatch. Mr Dixon was an original member of the CMA Technical Committee, and he has served continuously and twice been chairman of the RCMA technical committees. During the second World War he was a member of several committees and panels of the Cable Makers (War Emergency) Technical Committee and has represented the CMA on BSI committees. In 1952 the Institution of the Rubber Industry published the History of the Rubber Industry, and Mr Norman Dixon contributed a chapter on 'Electric Cables, Wires and Rubber Insulations.'

IRI Southern Section

On Saturday afternoon, May 9, a party of Southern Section members of the Institution of the Rubber Industry visited the International Synthetic Rubber Co. Ltd., at Hythe. The party was welcomed by Mr R. Jackson, technical manager, and Mr N. F. Weymouth, public relations officer. The visitors were conducted around the plant and were shown the many intricate operations involved in the production of SB rubber.



Recently introduced by the Marley Group, Sevenoaks, Kent, Marley Acoustic Pyramids for walls and ceilings are formed from rigid PVC, perforated, and filled with mineral wool. The base of each pyramid is 22 in. square, including a ½ in. flange; the depth is 8½ in. At a frequency of 1,000 cycles per second the absorption of these pyramids reaches the exceptionally high value of 95%. For all frequencies from 125 to 2,000 cycles per second, the absorption exceeds an average of 60%. The number of pyramids, and their positioning, can be calculated on acoustical engineering principles to give the best possible result. The Marley Tile Company is prepared to make specific recommendations for the reduction and control of sound in any given building

Rubber Technology

RUBBERS FOR SERVICE AT ELEVATED TEMPERATURES

By 'CROSSLINK'

THE demand for higher performance in rubber compounds stems largely from design engineers in the more progressive technical industries concerned with the manufacture of aircraft, nuclear reactors and space rockets, to name but a few spectacular examples. Development in some of these fields has been so rapid that the polymer technologist has not been able to meet fully the demands made upon him without the establishment of long-term research programmes leading to the development of completely new materials and methods. Some of the earlier long-term programmes initiated during or immediately after the war have now borne fruit and we are slowly piecing together a picture of what we may expect from rubbery materials under unusual conditions of service although much information has still to be gained by somewhat unsatisfactory extrapolation from the results of tests under more normal conditions.

The requirement that rubbers should retain their physical properties on long exposure to high temperatures is not in itself unreasonable. Even natural rubber, which is not regarded as showing outstanding resistance to heat will, in fact, retain high strength and reasonable flexibility and elongation provided that exposure is in vacuo or in an inert atmosphere. Under these conditions, the principle changes which occur will involve continuation of the chemical cross-linking process leading to hardening and eventual embrittlement, effects which can be minimized by suitable choice of curing system and by removal of certain products of breakdown of the curatives during the vulcanization process which may function as oxidation catalysts. In practice, the exposure of many rubbers to high temperatures occurs in the presence of air and this presents a very different problem. Oxygen reacts readily with organic compounds at elevated temperatures and, in the case of rubbers, scission reactions occur which result in a deterioration of the cross-linked rubber structure leading to softening of the compound accompanied by loss of resilience and increase in permanent set and creep.

Alternatively, the oxygen may act as an additional cross-linking agent leading to hardening and ultimate embrittlement of the rubber compound. The importance of these oxidative effects makes it of the greatest significance to define clearly the exact conditions of service for a rubber compound at a given temperature. Immersion in hot oil may not be an additional bogey to the technologist but rather a saving grace since it will protect the polymer from the unwelcome attentions of oxygen. Even if service is to be in air, pressure, flow rate, thickness of the rubber section and other variables must all be taken into account before recommending a given compound for service within a given range of elevated temperature. In addition, the other mechanical conditions of service, whether the component is to be in tension, in compression, subject to abrasive wear, etc., will also influence the technologist in his choice of material.

The Temperature Bands

Despite the impossibility of solving high temperature problems by the application of rule of thumb methods, certain general principles have become established which may be applied with advantage to such problems in order to suggest a promising line of development or to rule out those materials which are unlikely to prove satisfactory.

It is convenient to divide up the rubber service temperature scale into a number of arbitrary bands, each of which may be taken to mark the limit of high temperature serviceability of a polymer or range of polymers although special compounding techniques may sometimes be effective in moving a polymer up to the next higher band or (rarely) even two bands higher. The limits which we suggest are:

Up to 70°C.	Band I
70—100°C.	„ II
100—130°C.	„ III
130—160°C.	„ IV
160—200°C.	„ V
Above 200°C.	„ VI
[Higher temperatures	„ VII]

Again, the variables which must be adjusted to meet a given set of service conditions may also be grouped as follows:

1. Choice of polymer or blend of polymers;
2. Compounding of the polymer(s);
3. Processing of the resultant compound, in particular the conditions of vulcanization.

Since (1) is usually the most important in limiting high temperature performance, it is common practice to first choose the polymer and then to adjust (2) and (3) to give optimum performance in 'accelerated ageing tests' of a rather *ad hoc* nature conducted in the laboratory. Where two or more base polymers show rival advantages, lengthy comparative programmes are often necessary before a final decision is reached.

Choice of Polymer

Nearly all rubbery polymers show good performance up to 70°C. (Band I). With special compounding, such as for example the use of sulphurless curing systems, dithiocarbamate and other powerful antioxidants, the general purpose rubbers NR and SBR can be made serviceable in the Band II region.

Above 200°C., it is well known that the only polymers which will give satisfactory service lives are the silicone rubbers and the more costly fluoroelastomers which show the additional advantage of resistance to swelling by contact with oils.

Within the range 100—200°C., there is a wide choice of synthetic elastomers:

IIR (Butyl), CR (Neoprene), NBR, Polyurethanes—Band III.
Chlorosulphonated polyethylene, Acrylic rubbers—Band IV.

Again, by careful attention to compounding and curing technique, the performance may often be extended so as to become satisfactory in the next higher temperature band, particularly in those cases where exposure to the higher temperature is intermittent. Exceptionally, as in the case of 'resin-cured' butyl, even greater extension of performance is feasible.

Comparison of the structures of some rubbery polymers (Table I), shows that chemical saturation (*i.e.*, the absence of double bonds) in the main chain structure is of great importance in the development of satisfactory high temperature performance. This is particularly true for service in air where oxidative attack at the double bonds is believed to play an important part in the deterioration process. It will be noted that certain

TABLE 1

Polymer	*Typical Structure Units*	*Temperature Band* (upper limit for continuous service)
Natural Rubber	$\sim[-CH_2-C(CH_3)=CH-CH_2-]\sim$	I—II
Styrene-butadiene rubber	$\sim[-CH(C_6H_5)-CH_2-]\sim[-CH_2-CH=CH-CH_2-]\sim$	I—II
Neoprene	$\sim[-CH_2-C(Cl)=CH-CH_2-]\sim$	II—III
Nitrile rubber	$\sim[-CH(CN)-CH_2-]\sim[-CH_2-CH=CH-CH_2-]\sim$	II—III
Butyl rubber	$\sim[-CH_2-C(CH_3)=CH-CH_2-]\sim[-C(CH_3)_2-CH_2-]\sim$	II—IV
Polyurethane	$\sim[O.CO.R.CO.O.R']-O.CO.HN.-R''-NH.CO.O-[\ ]\sim$	II—III
Hypalon	$\sim[-(CH_2)_3-CHCl-(CH_2)_3-]\sim[-CH(SO_2Cl)-]\sim$	III—IV
Polyacrylic rubber	$\sim[-CH_2-CH(COOC_2H_5)-]\sim[-CH_2-CH(OC_2H_4Cl)-]\sim$	III—IV
Silicone rubber	$\sim]-Si(CH_3)_2-O-]\sim$	V—VI

polymers though unsaturated may still give adequate high temperature service. In the case of CR, the substitution of the polar grouping Cl seems to exert a deactivating effect upon the adjacent double bond at least so far as oxidation reactions are concerned. IIR contains very little unsaturation, the maximum in commercial grades being about 2.8% and the minimum about 0.5%. While it might be anticipated that the lower unsaturation grade would show better performance at high temperatures, this is not, in fact, what is found, since IIR is subject to thermal depolymerization by 'peeling off' isobutene units which results in a lowering of the linear molecular weight. This occurs more readily in the low unsaturation grades which cannot be cured tightly with sulphur. The technical result of this 'reversion' phenomenon is that the rubber softens and shows decreasing resilience and increasing set (although tensile strength and elongation at break may not change much in the early stages of the process).

There is little doubt that in our present state of knowledge Bands III–V give the greatest scope for improvement in compound performance, processing and economics by application of the principles of polymer technology. Probably second only to the advances in the design of 'tailor-made' heat resistant synthetic rubbers, are the spectacular advances in compounding methods which have developed over the last decade.

Compounding

When faced with a specific problem involving the use of an unfamiliar synthetic rubber, the wise technologist will usually consult the published compounding literature before commencing work on an evaluation programme. There is a tendency for manufacturers' literature to become choked with arbitrary details that obscure the main principles of compound design which must be applied to obtain the best possible performance from a given polymer. Such is the *ad hoc* nature of much compounding research, it is inevitable that the answers to some problems should be given in terms of patent additives and obscure processing operations, particularly when the research was carried out under the pressure of customer service as is so often the case in industry today. So great a mass of information of this type has accumulated that the technologist stands a great risk of becoming lost in a vast forest wherein it is not easy to see the wood for the trees or even the trees themselves on account of the thickness of the undergrowth.

In clearing a space for the principles of compound design to flourish, we may indeed sacrifice a small amount of valuable material the presence of which remained unsuspected, but surely this will be a small price to pay for the pleasure of watching the dead wood or waste paper of much present - day compounding literature burning merrily on the bonfire. Surely our major raw material suppliers now support sufficient graduate polymer technologists to design their evaluation experiments scientifically, to report the results with some regard to their levels of significance and to give some indication of the contribution of their work towards the advancement of compounding science as a whole. It is surely not for want of satisfactory models in this respect since the two research associations are at pains to set us excellent examples.

While each rubber will require special treatment, the general requirements for compound stability are common to the majority of materials. It is merely the means of achieving these requirements which may differ. The principal compounding variables which influence high temperature performance are:

(a) The vulcanizing system
(b) The nature and quantity of plasticizers and softeners
(c) The addition of antioxidants and stabilizers
(d) The properties of fillers.

The Vulcanizing System

For unsaturated rubbers, it is well known that 'normal' sulphur curing systems are unsatisfactory since the resulting network is subject to reversion. Better results are obtained when thiuram disulphides and other sulphur donors are employed although it is difficult to explain the observed improvement if we assume that the resultant cross-links contain sulphur in each case. A possible explanation which has been advanced attributes the high temperature stability at least in part to the protective effect of the dithiocarbamates formed by decomposition of the thiurams during the vulcanization process.

In a number of rubbers, progressive hardening and subsequent loss of flexibility is caused not only by oxidation but by continuation of the vulcanization process and this can often be overcome by ensuring that no residual vulcanizing agent remains at the end of the curing process. In some rubbers, the balance between reversion conditions and excessive cross-linking is quite delicate: for example, the polyacrylic rubbers which are vulcanized with sulphur and polyamines will revert when a small excess of sulphur is used and will harden with excess of amine.

The peroxides are valuable curatives for high temperature rubbers since they are readily decomposed at curing temperatures to yield volatile products which can be removed at least from thin sections of rubbers. The peroxide vulcanization seems to give rise to direct carbon to carbon cross-links which, of course, are not subject to reversion as are the sulphur links. While of interest in curing organic rubbers for special purposes, the peroxides come into their own in the vulcanization of silicone rubbers where variation of the nature and concentration of peroxide provides a really valuable compounding technique.

(To be Continued)

Change of Address

H. A. Coombs Ltd., rubber product manufacturers, formerly of Standard Works, Richmond Road, Wimbledon, London, S.W.20, has moved to larger premises at Standard Works, Red Lion Road, Surbiton, Surrey. Telephone: ELMbridge 5201.

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Factice-Compensated Acceleration of SBR

By C. FALCONER FLINT, Ph.D., D.I.C., B.Sc., A.R.C.S., F.R.I.C., F.I.R.I.

(Concluded from May 16 issue, page 738)

SUMMARY

After preliminary experiments, a detailed compounding study based on a type of 1502 SBR loaded with HAF black and accelerated with CBS (cyclohexyl benzthiazyl sulphenamide), has been carried out. It has been demonstrated that economies in SBR compounding can be effected by reducing the acceleration by 40% or more, compensating the adverse effects of this reduction by addition to the compound of a small (e.g. 5 phr) proportion of a low grade vulcanized fatty oil of an appropriate 'factice' type. This factice addition, without change in the time of cure given, is shown to maintain some properties (e.g. tensile and abrasion resistance) at the value observed before acceleration is reduced, actually to improve other properties (e.g. compression set, tearing energy, resilience and resistance to cut growth) and to be without adverse effect upon oven ageing characteristics. It is pointed out that the cost of the factic added need not be set off against the saving in accelerator cost because in the case of most SBR compounds, the volume cost of the factice added is actually less than that of the compound to which it is to be added, so that the factice actually cheapens the mix. Thus, the whole of the saving on acceleration is substantial and not merely apparent. In addition, the small addition of factice imparts valuable improvements to the processing properties of the compound, greatly enhancing (a) safety from scorch, (b) resistance to collapse after shaping, (c) docility to processing and shaping, and (d) extrusion rate and extrudate quality. This small addition of factice also promotes cool running on the mill and brings about a noticeable reduction in the time required for incorporation of the black. The term 'factice-compensated acceleration' is suggested, and systematic procedure for applying this principle to SBR compounding is discussed.

Sulphenamide Compensation: Choice of Factice Type

The next step (Table 10) was at the same time of cure (optimum for the control compound), to compare the four factice types at the same loading (5 phr) in the low accelerator (0.6) compound.

The results would appear to be slightly in favour of the factices based on rapeseed oil, and on economic grounds the grade three factice RO3 would be preferred, owing to its low volume cost. It is interesting to note that the important property compression set, which is a fundamental characteristic of properly vulcanized elastomers and which is significantly increased by the reduction in acceleration, is restored to its original low value by the addition of factice.

Sulphenamide Compensation: Choice of Factice Proportion

Having selected the RO3 factice as of value for addition to this SBR compound, it will be of interest to see whether there is a particular proportion that should be used to compensate (without changing cure time) the effect on properties of a 40% reduction in the (CBS) acceleration. Broadly speaking, within the range of factice additions explored (2.5 phr to 10 phr) no very definite conclusions appear to emerge, except a general indication that, for the purpose of compensating this accelerator reduction, it would be best to remain well within the limits indicated, using about 5 phr of factice.

The extension data obtained in a search for the optimum proportion of RO3 are given in Table 11, which includes air oven (70°C.) ageing figures. A more severe test was applied here, the period in the oven being increased to 14 days.

It will be seen from Table 11 that, in comparison with the control (high accelerator, no factice), all factice additions examined (2.5 phr to 10 phr) increase the tensile strength at the same time of cure, and all show a slight tendency (of doubtful significance) to improve oven ageing as assessed by tensile deterioration. On tensile, 2.5 phr of factice might be preferred. In the case of elongation at break, the increase on the control attributed to 7.5 phr and even to 5 phr of factice may not be significant, neither may the slight fall in elongation retention on ageing. The best attempt to maintain the 300% modulus value of the control (note, however, from Table 12 that *compression* modulus which is of greater service significance than extension modulus, is unaffected) is made by factice proportions of 5 phr, 7.5 phr and 10 phr, and there is perhaps little to choose between them. Aged 300% modulus figures could not be determined, owing to the shortening of the vulcanizates during this ageing period (see elongation figures, Table 11). All hardness figures show a small fall, except that for 2.5 phr, but this is of minor importance.

TABLE 10

Low CBS/HAF/SBR compound: Effect of 5 phr of 4 factice types. All cures 40 min. at 141°C.

Test applied	Control (1.0 CBS no factice)	Blank (0.6 CBS no factice)	With 5 phr factice and 0.6 CBS			
			RO1	RO3	GO1	GO2
Tensile strength (psi) ..	3,240	1,695	3,230	3,275	2,990	3,220
Modulus at 300% (psi) ..	2,347	508	1,610	1,500	1,350	1,437
Elongation at break (%) ..	425	800	575	600	600	587
Hardness °BS	67	55	65	65	64	64
Compression set* (%) ..	2.6	3.3	2.5	2.5	2.5	2.7

* Room temperature, 24 hours at 30% deflection between glass paper surfaces: expressed as a percentage of the uncompressed (original) height.

Compression Properties, Resilience, Abrasion Resistance and Tearing Energy

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TABLE 11

Low CBS/HAF/SBR compound: Comparison effects of a range of RO3 additions. Extension tests and oven ageing data (14 days at 70°C.). All cures 40 min. at 141°C.

Test applied	Control (1.0 CBS no factice)	Factice content (phr) of compound (0.6 CBS with RO3 factice) 2.5	5	7.5	10
Tensile strength (psi):					
BA	3,120	3,450	3,280	3,285	3,390
AA	2,390	2,830	2,705	2,580	2,715
% Retention	77	82	82	78	80
Elongation at break (%):					
BA	400	562	482	450	500
AA	225	268	237	222	235
% Retention	56	48	49	49	47
300% Modulus (psi) BA	2,300	1,700	1,848	1,831	1,872
Hardness (°BS) BA	67	67	63	63	61

BA = Before ageing AA = After 14 days in an air oven at 70°C.

TABLE 12

CBS/HAF/SBR compound: Other physical tests data (before ageing). Cylindrical test pieces ¾in. dia. × ½in. high cured at 141°C. for times equivalent to 40 min. cure of tensile testing sheets $\frac{1}{10}$in. thick

Test applied	Control (1.0 CBS, no factice)	Factice content (phr) of compound (0.6 CBS) with RO3 factice 2.5	5	7.5	10
Compression set (%)* ..	2.8	2.6	2.7	2.8	2.8
Static compression modulus (Yerzley, psi)‡	1,200	1,100	1,180	1,200	1,070
Resilience (Yerzley, %)‡ ..	49	53	55	55	56
Abrasion resistance (Croydon-Akron, ccs. per 1,000 revs.)	0.58	0.59	0.58	0.63	0.62
Tearing energy (foot pounds per square inch)†	662	805	682	681	652

*Room temperature, 24 hours at 30% deflection between glass paper surfaces: expressed as a percentage of the uncompressed (original) height.

† Method based on work of Greensmith and Thomas (*J. Polymer Sci.*, 1955, **18**, 189).

‡ See reference in Table 2.

appear from Table 12, it might be best to select 5 phr of the RO3 factice. The results shown in Table 11 indicate a wide tolerance on the basis of the conventional extension and oven criteria, and it was thought important to examine some properties of more direct service significance, the cure time given again being that required for optimum in the case of the control compound (high accelerator, no factice). The results obtained will be found in Table 12.

Compression set, an important indication of vulcanizate quality, is an improvement on the control in the case of the factice-compensated compound, and shows a slight preference for 2.5 phr factice, but 5 phr would be equally acceptable. The differences from the control in static compression modulus are small and of limited significance, but in view of the indication of the extension tests that factice does not fully compensate the loss of 300% modulus caused by a 40% reduction in acceleration, it is important to note that the more practically significant property, static *compression* modulus, is unaffected by the change from high acceleration to low acceleration compensated with factice. The slight preference here would appear to favour 5 phr factice, in view of other considerations. Resilience appears with all factice proportions in the compensated compounds to show a substantial improvement on the control, but here again, 5 phr of factice is favoured. The abrasion test indicates that at 5 phr of factice, the abrasion resistance value of the control is maintained. The tearing energy figures favour 2.5 phr of factice, at which level the improvement on the control is substantial, but the value at 5 phr is still slightly better than that of the control.

So far, then, the decision would appear to be in favour of an addition to the low accelerator (0.6 CBS) SBR compound of 5 phr of the RO3 factice.

Cut-Growth and Flex-Cracking Resistance

Other very important service properties of these compounds for which only preliminary data are as yet available, are cut-growth and flex-cracking resistance.

The work on cut-growth resistance has indicated that in comparison with the control (high accelerator, no factice) all test pieces cured for the time required for optimum in the control, the factice-compensated low accelerator compounds have greatly improved resistance to cut growth. Figures illustrating this point, in the case of additions of the RO3 factice, will be found in Table 13.

Table 13 not only shows the very striking improvement in cut-growth resistance as compared with the high accelerator *control*, but also shows by reference to the *blank* (Table 10) that the effect is not attributable merely to the fall in modulus resulting from reduction in acceleration but is directly caused by the factice-compensation effect. Although factice compensated acceleration reduces somewhat the modulus of the high accelerator control, the modulus of the low acclerator blank is actually *increased* (about three times) by the factice which, at the same time, also increases cut-growth resistance by several times.

It is widely admitted that attempts to use laboratory tests to evaluate the flex-cracking resistance of SBR vulcanizates have to meet the difficulty of crack initiation at the edge of the test pieces. On account of this complication, it is difficult to be certain that the flex-cracking resistance values of the low accelerator vulcanizates containing the RO3 factice are, at the time of cure required to give optimum in the control compound (high accelerator, no factice), very much better than those of the control.

Such, however, is the indication and it can at least be concluded from the results obtained that the flex-cracking resistance of these factice-compensated vulcanizates containing factice is not inferior to that of the control.

TABLE 13

CBS/HAF/SBR compound: effect of factice-compensated acceleration reduction on cut-growth. (All cures 50′ at 141°C. (equivalent to 40′ for 2mm. sheets—the optimum for control compound).

Compound tested	No. of de Mattia flexings to extend puncture cut in test pieces as below: 4mm. cut to 8 mm.	8mm. cut to 12mm.
Control (1.0 CBS, no factice)	325	330
Blank (0.6 CBS, no factice)	850	3,350
2.5 phr RO3 (0.6 CBS)	9,800	17,000
5 phr RO3 (0.6 CBS) ..	3,600	7,100

Improvements in Processing Characteristics

It remains, therefore, to examine the influence of factice addition on the processing characteristics of these reduced accelerator compounds. Williams plastimeter data will first be considered as these give a very reliable picture of docility to processing dimensional stability and resistance to collapse after shaping. Table 14 gives Williams data for the reduced (0.6)

accelerator compounds containing 5 phr of the four factice types, and Table 15 gives the Williams data for the range (2.5 phr, 5 phr, 7.5 phr and 10 phr) of proportions of the one factice finally selected (RO3), in the low accelerator compound (0.6). In each case, comparison is with the control (high accelerator, no factice).

From the first column of Table 14, it will be seen that the compounds containing 5 phr of factice are much stiffer than the control, indicating correspondingly improved resistance to collapse after shaping. The low 'difference' figures in the third column, representing a big drop from the comparatively lively control, indicate the effect of factice in conferring almost complete deadness, dimensional stability, or docility to shaping.

Table 15 indicates that this effect of factice in taming the rebellious nature of this SBR compound is already substantially complete, in the case of the RO3 factice, when as little as 2.5 phr has been added.

Garvie Die Extrusion Assessment of Processing Characteristics

The processing properties of these modified compounds were compared by means of extrusion through the Garvey die (see Falconer Flint, Featherstone and Donnelly, *Trans. IRI*, 1957, *33*, page 208, Figs. 18 and 19). A description of the rates of extrusion and extrudate characteristics observed will be found in Table 16, and visual comparison of the extrudates can be made by reference to the photograph (Fig. 7). That the reduced accelerator compound containing 5 phr of RO3 factice shows, in comparison with the control, a very great improvement in processing properties, is very evident. The substantially increased rate of extrusion shown by this factice - compensated compound will also be noted.

TABLE 14

CBS/HAF/SBR compound: Effect of factice types (5 phr) on Williams compression and recovery. Conditions: 2 cc. pellet, 4.7 kgm. load, pellet conditioned 15′ at 70°C., compressed 10′ at 70°C., recovery 10′ at 70°C. and 10′ at room temperature

Sample tested	Height after compression (% of original height retained after 10′ load)	Height after recovery (% of original height measured after removal of load)	Difference between height after compression and height after recovery (% figures)
1.0 CBS, no factice ..	31%	51%	20
0.6 CBS + 5.0 RO1 ..	50%	53%	3
0.6 CBS + 5.0 RO3 ..	52%	54%	2
0.6 CBS + 5.0 GO1 ..	46%	495%	3.5
0.6 CBS + 5.0 GO2 ..	54%	55%	1

Notes on this test: 1. The higher the height after compression, the greater the resistance to deformation under load; 2. The higher the difference figure, the greater the nerve or memory of the compound. A low difference figure indicates deadness or docility to shaping.

TABLE 15

CBS/HAF/SBR compound: Effect of range of RO3 proportions on Williams Plastimeter data. Conditions: 2 cc. pellet, 4.7 kgm. load, pellet condition 15′ at 70°C., compressed 10′ at 70°C., recovery 10′ at 70°C. and 10′ at room temperature

Sample tested	Height after compression (% of original height retained after 10′ load)	Height after recovery (% of original height measured after removal of load)	Difference between height after compression and height after recovery (% figs.)
1.0 CBS, no factice ..	34%	57%	23
0.6 CBS + 2.5 RO3 ..	57%	59%	2
0.6 CBS + 5.0 RO3 ..	59%	60%	1
0.6 CBS + 7.5 RO3 ..	60%	61%	1
0.6 CBS + 10 RO3 ..	62%	63%	1

Notes on this test: 1. The higher the height after compression, the greater the resistance to deformation under load; 2. The higher the difference figure, the greater the nerve or memory of the compound. A low difference figure indicates deadness or docility to shaping.

TABLE 16

Low CBS/HAF/SBR compound: Effect of factice on Garvey die extrusion properties (1½in. extruder 80 rpn scroll speed) of low (0.6) CBS compound

Compound extruded	Extrusion rate (in. per min.)	Description of Garvey die extrudate		
		Edge	Surface	Section
Blank	14	Very irregular	Very rough	Swollen and irregular
2.5% RO3	18	Slightly irregular	Slightly uneven	Slightly swollen. Fair definition
5.0% RO3	20	Good straight edge	Smooth surface	Slightly swollen. Good definition
10% RO3	24	Fine feather edge	Smooth surface	Good clear definition

Scorch Values for Factice-compensated SBR Compounds

Some information on the Mooney scorch values of these factice-compensated compounds will be of interest (see Table 17).

TABLE 17

Mooney scorch at 120°C. CBS/HAF/SBR compound with 0.6 CBS and 5 phr factice: comparison of factice types.

Factice type present	Scorch time* (min.)
RO1	33
RO3	37
GO1	49
GO2	34
Control (1.0 CBS, no factice)	32

* Time required to attain a viscosity increase of 2 units per minute.

From the above, it will be seen that the compound containing RO3 factice is five minutes safer at 120°C. than the control.

Safety of Factice-compensated SBR Compounds (mill mixing Temp.)

TABLE 18

HAF/SBR compound (accelerator omitted because normally added last): Effect of factice on milling temperature

Compound prepared (see Table 8) based on 200 g. batch of polymer. Accelerator omitted (usually added last in compounding)	Nip temp. at completion of mixing and refining	Stock temp. at completion of mixing and refining
No factice ..	50°C.	67°C.
With 5 phr RO3 ..	40°C.	58°C.

Notes: 1. Rolls at same temperature at beginning of both experiments: rolls filled with water and sealed off; nip temperatures measured by means of a thermocouple set in the guides. Stock temperature measured with a needle pyrometer; 2. 'Nip temperature' was indicated by a thermocouple inlaid at the apex of one of the guides and therefore in contact with the rolling bank of compound.

Further experimental evidence was sought on the subject of safety. A 200g. batch of the 5 phr RO3 compound was made up without accelerator (which is normally added last, so could not affect the experiment) on a laboratory open roll mill, starting with cold rolls at the same temperature but without cooling circulation (the cooling water was sealed off in the rolls by closing the valves). The stock temperature at the moment when compounding and refining were complete was 9°C. lower than that of a similar batch weight of the same un-

accelerated compound without factice. Details will be found in Table 18.

The two compounds were prepared by the same skilled operator in as efficient a manner as possible, every endeavour being made to simulate works conditions.

factice in the polymer, other conditions including pre-mastication being kept as strictly comparable as possible, a 50% saving in black incorporation time was observed, and a 23% saving in total compounding time (see Table 19).

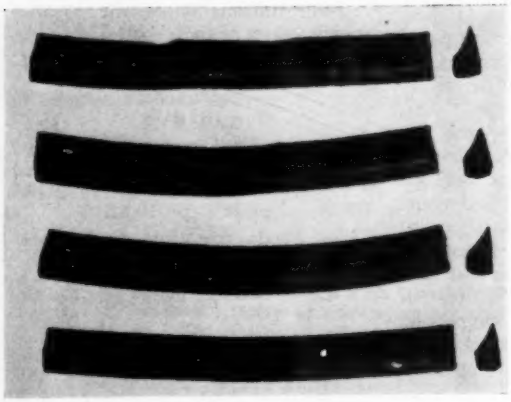


Fig. 7. Garvey die extrudates (CBS/HAF/SBR compound). *From top:* No factice; 2.5% RO3 factice; 5.0% RO3 factice; 10% RO3 factice

Recalling that (a) in the case of SBR compounds the scorch time appears to increase by a factor of nearly two for every 10°C. drop in processing temperature, and (b) that even at the same temperature, the factice-compensated compound is safer than the control (see Table 17), it will be realized just how impressive the safety factor of this factice-compensated SBR compound is in actual processing practice.

Saving in Compounding (Black Incorporation) Time

Finally, attention is directed to the saving in compounding time achieved when preparing the factice-compensated compound. A 'filler incorporation test' was carried out by noting the time required for the incorporation of 100g. of the HAF black into 200g. of the SBR polymer plus ingredients of the Table 8 compound other than the accelerator (added last in any case). With 5 phr of the RO3

TABLE 19

Compound based on 200 g. SBR as Table 8, but prepared without accelerator (normally added last(, black or factice. Black then incorporated according to normal compounding procedure

	No factice present	5 phr of RO3 factice type
Time required to incorporate 100 g. of HAF black	9 min.	5.5 min.
Total mixing time, including pre-mastication of polymer ..	15.5 min.	12 min.

CANADIAN RUBBER CONSUMPTION

Consumption of natural, synthetic and reclaim rubber in Canada in February increased sharply (45%) to 23,223,000lb. from last year's corresponding total of 15,960,000. Natural rubber consumed rose to 8,301,000lb. from 5,558,000 a year earlier, synthetic to 11,588,000lb. from 7,837,000, and reclaim to 3,334,000lb. from 2,565,000. Natural rubber consumed in the month accounted for 35.7% of total consumption compared to 34.8% a year earlier, synthetic for 49.9% versus 49.1%; and reclaim for 14.4% against 16.1%.

Total rubber consumed in the manufacture of tyres and tubes in February advanced to 16,080,000lb. from 10,090,000 a year earlier, in footwear to 2,112,000lb. from 1,780,000 and in 'other' products to 4,497,000lb from 3,559,000. Consumption of rubber in the output of wire and cable was practically unchanged from a year ago at 534,000lb. versus 531,000.

IRI Golfing Society

LONDON SECTION MEETING

THE opening meeting of the season, when members of the London Section IRI Golfing Society were competing for the London Challenge Cup, was held at Walton Heath and resulted in a very popular win for Mr F. L. Davis (London Rubber Co. Ltd.).

Some thirty members and their guests turned up but unfortunately the weather in the morning was appalling which makes Mr Davis's performance all the more meritorious. The competition as usual took the form of a Stableford and the winner secured 33 points. Other leading scores were: H. Lockett 31, I. Keith 30, and A. H. McCulloch 27. The Visitor's Prize was won by Harry Coles with 29 points. Mr Coles has been a frequent guest of Ian Keith and is, therefore, well known to the members of the London Section.

In the unavoidable absence of our Captain, Mr Val Jorey, Mr Denzil Davies presented the prizes, which had been generously donated by himself, Ian Keith and Joe Ruffell.

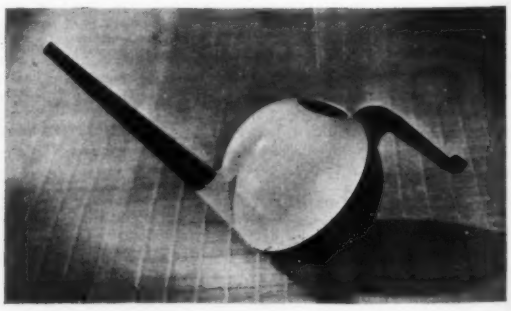
—H. R. C.

SCOTTISH SECTION

The Spring meeting of the Golfing Society, Scottish Section, The Institution of the Rubber Industry, for Captain's Prize and Southerness Tankard was played over Largs Kelburn Golf Course on April 16 under good conditions. Except for one, return scores showed that members were still a bit rusty after the winter lie-off and that some intensive practice was badly required.

The leading scores were: W. Johnston, 87−17=70; W. S. Alexander, 84−8=76; J. Picken, 100−24=76; J. McKechnie, 87−10=77; P. W. Bell, 82−4=78; R. P. Yates, 85−7=78; W. Boyd, 97−17=80.

The McElroy Medal and prize held over from last year because of a tie with J. M. Gallie went to J. McKechnie. Prizes were donated by the captain and secretary.—J. M. G.



A novel yet extremely practical watering can is now being manufactured by Taylor Law & Co. Ltd., Stourbridge. Moulded in two tones with Styron polystyrene, from British Resin Products Ltd., the can is designed primarily for use in watering indoor plants. It retails at 5. 11d.

Director of Research:
C. Falconer Flint,
B.Sc., Ph.D.(Lond.), A.R.C.Sc., D.I.C., F.R.I.C., F.I.R.I.

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VIEWS and REVIEWS

Polymer Deformation

AT the Joint Conference of the Institution of the Rubber Industry and the Plastics Institute held in London on February 27 1958, a paper on 'Chemical Reactions Induced by Polymer Deformation' was read by Dr W. F. Watson (then of British Rubber Producers' Research Association; now Director, Research Association of British Rubber Manufacturers). This paper constitutes Publication No. 299 of the BRPRA, and has now been reprinted (from *IRI Transactions*, 1958, Vol. 34, 237).

In introducing his subject Dr Watson said that it was the purpose of his 'talk' to review the literature on chemical reactions induced by mechanical energy, and to report on unpublished observations. It would be shown, he said, that mechanico-chemical reactions are not limited to rubbers, but occur during the processing of many polymers.

Also, the author pointed out, it was of special interest to him to report on the design of experiments to utilize our knowledge of mechanical initiation 'for producing novel reactions and new materials.'

A feature which is well worth mentioning and recognizing in connexion with the importance—as I believe—of the subject is that 'Almost all of this work until recent date has emanated from the laboratories of the British Rubber Producers' Research Association' and, as Dr Watson modestly puts it 'I take this opportunity of acknowledging the co-operation of several colleagues, in particular D. J. Angier and R. J. Ceresa.'

(A feature of the last sentence is that Watson's own part in this pioneer work was first reflected in a paper published (with M. Pike) in *J. Polymer Science* in 1952, and also in *Trans. IRI* in 1953.)

Discussion

The purport of the above is, I believe, already well known, through the publications and reviews of the subject, but I think that the import of some matters raised or referred to in the Discussion may be interesting to many—as they were to me: Certainly Dr Watts' remarks, to begin with, are calculated to impress one with the potential importance, both scientifically and industrially of mechanical action on polymers—especially rubber—and what stems therefrom. Thus:

Dr Watts, after congratulating Dr Watson on his survey (as reported), said: 'We watch with interest the progress of this fundamental technique, the results of which may not only make available to industry novel materials as modifications of natural rubber, but also provide industry with a novel method of working established machinery to obtain new and useful results. The scope of the technique described is shown by the reference to the wide range of synthetic materials, both plastics and rubbers, included in the results shown this morning.

'Whilst it is possible that the physical properties of the new materials may show no improvement on those of copolymers prepared by the usual methods, *i.e.* random copolymers, it may be that some of the processing properties will be improved, *e.g.* tack, scorch resistance, swell from the extruder. Has Dr Watson any general comments to make on these properties?'

Dr Watson replied to this question (*i.e.* properties of block polymers compared with random polymers) that so far no detailed work had been done in this regard, but it has become obvious while handling these materials that, in many cases they (*i.e.* the block polymers), differ from copolymers in physical properties.

An interesting question relating to the interaction between the polymer radicals and carbon black particles in regard to reinforcement was put, but it will be advisable to study this and other matters in the original.

'Milkiness' in Translucent Rubber

I am indebted to the author for a reprint of a paper on '"Milkiness" in Translucent Rubber' by H. J. Sherwood (Washington Chemical Co. Ltd., Research) published originally in the *Proceedings of the Institution of the Rubber Industry* (vol. 6, No. 1, 27).

In this work a study was made of the occurrence of 'milkiness' in translucent rubber stocks subjected to various degrees of strain. Two types of filler, both of British manufacture, were used in the experiments, namely, a '"translucent" grade of light magnesium carbonate, and a hydrated silica.' A translucent sole was also tested. For details of mixings and tests the original should be referred to. The author states that 'It is to be noted that in all cases the "milkiness" observed on stretching disappeared either largely or completely on release.' Amongst the conclusions from the experiments mentioned by the author are:

(a) The degree of stretch required before 'Milkiness' occurs is similar for both types of stock, especially at the slow rate of extension; (b) The 'milkiness' is not permanent, and (c) '"Milkiness" only occurs at elongations well above those which would normally be encountered in footwear production processes.'

A footnote to the paper reads: 'See also *Proc. Inst. Rubber Ind.* 1958, *3*, 73, and *5*, 106 (Editor).'

International Washington Conference

The Institution of the Rubber Industry has transmitted to members a Notice marked *Important* which informs them that they have been cordially invited to attend the above-mentioned Conference, which (as previously, but briefly, mentioned on this page a little while back) will be held in Washington, D.C., on November 8–13 1959.

The programme of the Conference will include papers covering all the broad and important fields of rubber chemistry, technology, testing, and rubber engineering,

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **DR SCHIDROWITZ**

and with *special reference to equipment and processes, and rubber as an engineering material.*

'The world's leading authorities will be presenting papers at the meeting.'

Official IRI Delegation

However, the chief point in the IRI 'Notice,' as I see it, is that in view of the importance of the Conference, and that a large number of IRI members are expected to attend, *the Council of the Institution considers that the best interests of both the Institution and of the Members would be served if UK participants were to attend as an official IRI DELEGATION.*

It is, therefore, requested that those who will be going to Washington for the Conference should send their names to the Secretary of the Institution for inclusion in the official list. Moreover, those who would like the assistance of the Institution *re* travel, accommodation, registration, etc., should notify, as soon as possible, the Secretary, Institution of the Rubber Industry, 4 Kensington Palace Gardens, London, W.8.

Personal

Dr A. E. Juve, who needs no introduction to readers of *RJIP*, writing to me personally from the Goodrich Research Centre, *as Chairman of the International Rubber Conference* recently, tells me that the technical programme 'promises to be a good one,' 'but more important will be the opportunity to renew acquaintance with many old friends from all over the world, and to meet some of the men who are only names to you now.' And, while very kindly saying that his letter is an invitation to me to attend, he opines that 'You undoubtedly have attended all the previous conferences of this type, and we sincerely hope that it will be possible for you to attend this one.'

In thanking Dr Juve for his charming letter—which was much appreciated as a kindly thought—I had perforce to tell my correspondent that I feared I would not be able to attend the Conference, but that I hoped I might have done a little something to rally those more fortunate than myself by way of a note in *RJIP* some little while ago. I say, therefore, quite sincerely, and not as a conventional locution, that all those who read these few lines should seriously ask themselves—if they have not yet come to an affirmative decision—not whether they can visit Washington, but whether they can afford to miss an opportunity to acquire valuable knowledge combined with a pleasing (and, possibly, vastly novel) experience, which may not readily recur.

Radiation Curing

The April 1959 issue of the *Proceedings* of the *Institution of the Rubber Industry* (vol. 6, No. 2, 45) contains an interesting and thoughtful study by Dr R. M. Black (British Insulated Callender's Cables Ltd., Research) of 'Some Aspects of the Radiation Curing of Rubber and Plastics,' a paper read at a joint meeting of the South Wales and Monmouthshire Sections of the Institution of the Rubber Industry, with the Plastics Institute, in Cardiff on December 8 1958.

'Practical' Aspects

It is to be gathered, as it seems to me, from the nature of Dr Black's paper that, broadly, we may still, notwithstanding its 'intensive study,' as he puts it, be on the threshold of a vast and important field of industrial knowledge. I do not propose even to attempt to survey Dr Black's paper, either as a whole, or in its fundamental aspects, but merely to touch upon what, for want of a better term, I may be permitted to term 'practical' aspects or potential.

In his 'Conclusion' the author commences by referring to the 'intensive study' of the subject which has been made during the past six years, but that, in spite of this study (*i.e.* of the effects of high energy radiation — on natural rubber and plastics—) 'only in the case of polythene has irradiation been used as a production process, and this only upon a pilot plant scale.' And then he (Dr Black) proceeds: 'It would seem that where curing can be achieved by conventional methods there are serious objections to the installation of what must be fairly costly plant to achieve marginal improvements. The present value of irradiation curing is an alternative route to the understanding of the reactions involved and in the evaluation of the relationship between physical properties of plastics and their chemical constitution.'

And there I must leave this valuable publication, and with the suggestion that it should be studied as a whole by all those interested in a subject which, at least, may be of industrial import in the future of curing processes.

Notes

Recent literature received from Imperial Chemical Industries Ltd. includes a copy of an elegantly produced brochure of 35 pages with title 'Statistics as Applied in the Rubber Industry,' with sub-title 'A Series of Six Lectures Delivered at Newton Heath Technical School,' which is reprinted by permission from RUBBER JOURNAL AND INTERNATIONAL PLASTICS.

In a covering note it is mentioned that the lectures were delivered by members of the I.C.I. Dyestuffs Division, and it is added that I.C.I. have a very small number of spare copies, and that, while these last I.C.I. (Plastics Dept., Southern Region, P.O. Box 19, Templar House, 81-87 High Holborn, London, W.C.1) will be glad to meet requests for 'any extra need you may have.'

PHILIP SCHIDROWITZ

European Chemical Manufacturers

The Austrian, Belgian, British, Dutch, French, German, Italian, Swedish and Swiss Chemical Manufacturers Associations have decided to improve their collaboration and contacts by setting up a Centre Europeen des Federations de l'Industrie Chimique (CEFIC), the secretarial services of which are entrusted to the Swiss Association in Zurich.

CEFIC is a working agency of the directors and will be responsible for organizing their meetings and for the exchange of information. Contact with the Centre will be solely through the directors of the member countries.

Questions Corner—73

(Second Series)

311. Give brief details of some solution polymerizations which are of commercial interest.

312. Give some general details of the process for the extrusion of tubular film.

313. What methods may be used for testing polychlorotrifluoroethylene moulding and extrusion materials?

314. Are there any fire tests that are suitable for plastic building materials?

(Answers next week)

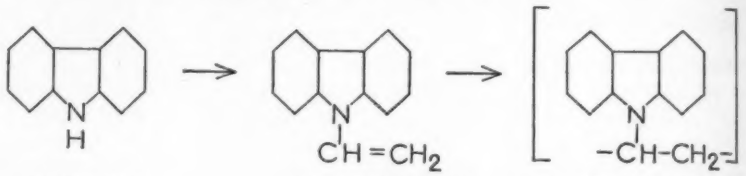
Answers to Questions Corner—72

307. There are a number of points to be considered when selecting a plastics extruder and the following are worth noting: a. An adequate entry for handling several types of material, *e.g.* granules, powder or chips. With a hopper big enough to take reasonable supply without the necessity for continual feeding. b. The barrel should be capable of being heated in a number of zones so as to permit a heat gradient from entry of the material to the die head. Accurate temperature control is essential. c. Although, as stated, provision for adequate heating of the barrel is required it is usually necessary to provide for water cooling in the case of excessive frictional heat. d. The screw should also be cored for water cooling or steam heating, but more especially the former. e. The screw should be capable of being easily removed so that screws of different designs as required by various polymers can be interchanged easily. f. variable speed motors should be provided so that the speed of the screw may be varied at will without the necessity of stopping the machine. g. A long screw, and barrel, is desirable to permit the development of an adequate pressure gradient. h. Finally, a plastic extruder should be capable of withstanding very high pressures and should therefore be of robust construction, and driven by motors of adequate hp.

308. Polyvinyl carbazole polymers are commercially available in the form varying from powder to lumps. Their impact strength is low but this can be improved by fibre reinforcement. They are resistant to dilute acids, alkalis and hydrofluoride but are attacked by concentrated sulphuric acid and nitric acid. They are swollen or dissolved by aromatic hydrocarbons, chlorinated hydrocarbons, esters and ketones but are insoluble in aliphatic hydrocarbons, alcohol, ether and carbon tetrachloride.

These polymers can be compression or injection moulded at about 340–460°F. for the former and about 430–600°F. for the latter. The temperatures depend on the amount of plasticization. Thin films can be cast from solution in tetrahydrofuran, and they possess a high dielectric breakdown strength, low power factor, with high resistivity at temperatures up to 300°F.

For impregnation the polyvinyl carbazole is applied to the assembly in a molten state at 160–185°F. under reduced pressure and the monomer polymerized in air at 230–250°F., to give a rigid assembly. Rolled paper condensers impregnated in this manner may be operated for a very long period at temperatures over 250°F. with little change in electrical properties.



309. BS 2782: Part 4: 1958 has been issued by the British Standards Institute incorporating a collection of analytical methods, etc., used in the testing of plastics and including:

Acetone soluble matter. — Three methods are given for determining the acetone soluble matter in phenolic mouldings, in phenolic material after moulding and phenolic moulding material before moulding.

Analysis of water extract of phenolic mouldings.—Several methods are given in this section including the determination, in phenolic mouldings, of ammonia and ammonia compounds, phenols, formaldehyde (colorimetric and gravimetric methods), sulphates, chlorides and pH of water extract.

Analysis of polystyrene. — Two methods are given for determining (a) the methanol soluble matter, and (b) the styrene content, using Wijs solution.

Viscosity in solution.—One method is for determining, by conventional methods, the viscosity in centipoises at 25°C. of a solution of polystyrene in toluol containing 0.02g. of polystyrene per millilitre. The other method is for determining the 'viscosity number' (see *J. Pol. Sci.* 1952, *8* (3) 269) of a solution in cyclohexanone of PVC resin, or of copolymer, in which the main repeating unit in the molecule is vinyl chloride. The method applies only to those resins that give stable solutions and reproducible results under the conditions of test.

Copies of the Specification may be obtained from The British Standards Institution, 2 Park Street, London, W.1. Price 6s.

310. In bulk and suspension polymerization the polymer molecules begin their growth in the monomer being the only solvent. In solution polymerization, however, a non-monomeric liquid solvent or diluent is added before commencement of the reaction.

For some speciality products solution polymerization is used and the resulting products are supplied to the consumer in the same solvent in which the polymerization has been carried out.

One of the advantages of polymerization in solution is that it is possible to have better control of the reaction than is possible with bulk polymerization. It is also a convenient method for use in the laboratory for the study of new monomers.

When the polymer is insoluble in the monomer-diluent mixture it may be recovered quite easily by filtration, in granular or powder form, which is easily washed and dried.

The rate of polymerization and the molecular weight of the products generally decrease with decreasing monomer concentration.

There are several limitations of solution polymerization including reduced reaction rates, lower molecular weight, cost of the solvents of sufficient purity, lower yield of polymer per unit of reactor space and the difficulty of removing the last trace of solvent from the polymer.

(More questions next week)

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MEN and MATTERS

A Review of People and Events

THERE has just taken place an interesting presentation to a veteran in the rubber industry, for on May 6 Mr Mountain S. Angus, a grandson of the founder of George Angus and Co. Ltd. of Newcastle upon Tyne, established so long ago as 1788, was presented with a gold watch by his co-directors. It was to mark his 50 years' service, completed three days before, but probably just as much to recognize his eminent position in this branch of British industry. Mr Angus, for many years joint managing director of the company, is known far and wide for the remarkable part he has played in the development of its export division, and all in all, his career provides a fascinating study of personal endeavour. It was entirely appropriate, also, that the watch

MOUNTAIN S. ANGUS

should have been presented by his brother, Colonel E. G. Angus, the chairman of the company.

The beginnings of Mountain Angus are recorded in the company's documents against the simple entry 'Joined staff today.' His salary was 5s. a week, and he was thereupon initiated into the manufacture of mechanical rubber goods—the first member of his family to specialize in a medium other than leather, the manufacture of which formed the bulk of the company's activities at that time. Two years later, when getting 7s. 6d. a week, and at 19, he was sent to Scandinavia as a sales representative, the first of many almost countless journeys, to take him equally countless miles to almost every country, and by almost every means of transport.

In this way he became equipped for his principal task—the establishment and development of the Angus Export Division. In 1923 he left his native Northumberland for London, where the headquarters of the Export Division were to be established. From then on his life was spent in almost continuous travel and he estimates that over six months of every year were, in fact, spent away from home.

One of the first business executives

by George A. Greenwood

in this country to make use of air travel, Mr Angus' early experiences reflect the pioneer spirit in which it was sometimes necessary to approach this method of transport.

'My 1930-31 experience of travelling from Entebbe in Uganda by Imperial Airways was something to remember,' he recalls. 'We landed at Juba in the Sudan with one engine out of action and no petrol, and remained there for ten days whilst we waited for a new engine to be flown out from London. During this time we lived mostly on unleavened bread and tinned fruit, except for one day when a goat was killed at six o'clock, and we tried to eat it at seven!'

Later he travelled extensively in India, mainly in single-engined and two-seater aircraft, but to get to his destinations he made use of wider varieties of transport. He went up the Nile by boat, for example, crossed Africa by car, and spent much time living in the Arabian and Persian oilfields.

Fittingly, he was appointed to the boards of all the Angus overseas companies — George Angus (Canada) Ltd., George Angus and Co. (South Africa) Ltd., George Angus (Rhodesia), (pvt. Ltd.), and Angus/Reddaway Co. of Sweden. He became the first George Angus director of the last-named company in 1955 under the seal of the King of Sweden.

Mr Angus maintained for many years a close connexion with the Army. He served throughout the 1914-18 War in the Royal Army Service Corps and Northumberland Fusiliers, and afterwards commanded a territorial unit. In 1926 he was appointed to the command of the Northumbrian Division RASC, and retired in 1930 with the rank of brevet colonel.

Now, he lives in the South of England with his wife and daughter and, whilst maintaining close interest in his native North Country, still retains the progress and further expansion of Export Division as his chief interest. As its principal founder, he has seen it grow from its beginnings in 1923, with a staff of five and a turnover of £70,000, to its present size, with 60 or 70 on the staff, and an annual turnover of approximately £1m.

That White Line

Widespread interest at home and abroad is being shown in the scheme launched on the initiative of Mr Harold Watkinson, Minister of Trans-

A picture, taken earlier this week, of 'Crystalex' marking on the A3 road at Esher, Surrey. The material, manufactured by Constructex Ltd., is referred to above

port, for safer road travel which has a notable plastic background. It appears that a double white line is now showing itself on more than 500 miles of British roads, and that here again plastics are at the base of it all. Mr William Duchatel Woellwarth, the man who has pioneered this invention, and who is in other directions a prominent City figure, has relied upon a plastic content as the basis of the marking medium, but one of the secrets of its success is that with it is mixed the tiniest highly reflective

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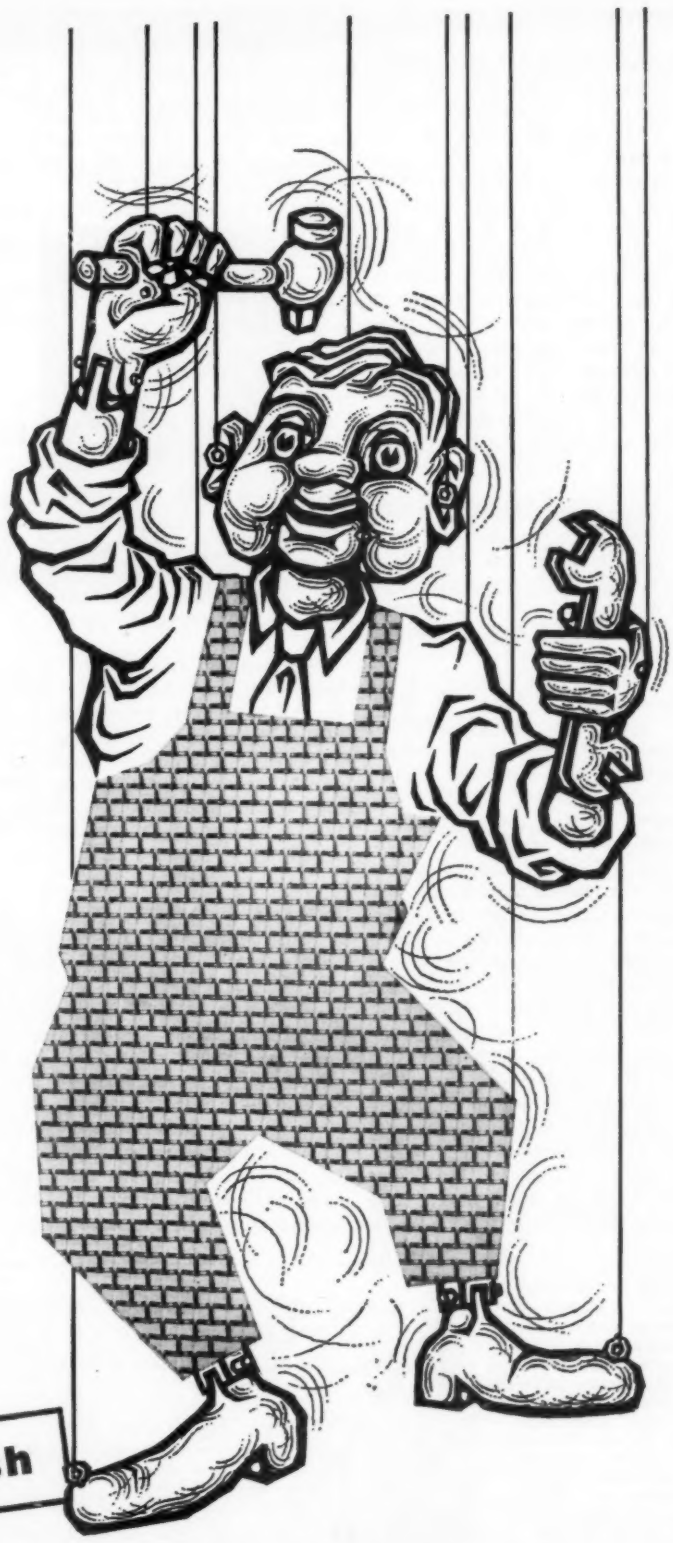

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glass globules, in appearance like sugar.

Since the enterprise became more widely known and talked about, and that is more especially since the new double white line regulations on the roads became law last week, there has been much speculation as to the precise nature of the plastic involved and in some quarters it has been assumed that it is PVC. Mr Woellwarth, however, tells me that this is not the case. The material is a form of thermo-plastics with a large proportion of sand, ordinary resin, oil, whiting, titanium dioxide, and about 20% by weight of the little glass spheres, which altogether make up the compound.

'And it is very cheap, too,' said Mr Woellwarth to me.

It appears that after the initial experiments which were made to keep traffic moving under black-out conditions during the Second World War, experts at the Paint Research Laboratory and the Road Research Laboratory developed this new plastic form and he made the first commercial experiments with it. Since the most modest beginnings, in an asbestos garage employing three men, the affair has expanded to a £200,000 a year concern with a payroll of 100. The Woellwarth concern now lays up to 3,000,000 yards of white lines a year, and there are about another dozen firms in the business, although the Woellwarth organization claims the major share. It has helped to make, so I am told, the runways of London Airport, the best marked in the world, and now Mr Woellwarth is working on contracts for the London-Birmingham motorway and the St. Albans by-pass. For us, of course, the essential fact is that the secret of success is not paint, but this plastic substance wedded to the globals. Mr Woellwarth says he is sure that the future lies in the crystal white line.

And he should know!

NBR Appointment

The North British Rubber Co. has announced the appointment of Mr T. S. Martin to the newly-created post of field sales manager, industrial products division, operating from the company's sales office at 62/64 Horseferry Road, London, S.W.1.

T. S. MARTIN

The son of Len Martin, a well-known engineer in the North West of England, he was educated at the Hulme Grammar School and at the College of Technology, Manchester. Mr Martin has had extensive experience of sales and sales management in capital equipment for commerce and industry.

Plastic Beds for Cows

More than once lately I have referred to the growing increase in the use of rubber and plastics for purposes which even a decade ago would have been thought most unusual, and probably fantastic. But the process still goes on, and in a sort of way, it is probably accelerated.

One of the latest of these developments is the provision of plastic beds of hygienic luxury for the herd of cows at Gosford Farm, near Kidlington, in Oxfordshire, about which I have just been talking with intense interest to the owner of the herd, Major Anthony Bramley. This retired Army officer, aged 56, a Londoner by birth, but an Oxonian by upbringing, is rhapsodic about what has happened since by a brainwave which he himself later developed—prickly straw beds for the ladies of the cowshed have been superseded by the hygienic luxury of these plastic foam mattresses. I am sure Major Bramley is a kindly man, but he is not at all moved entirely by sentiment in this introduction of the lushness of Park Lane to the amenities of his 56 British Friesians. He himself puts it as just hard economics, for the cows at Gosford are now giving 165 gallons of milk a day, which is round about three times the yield of the national average.

Now a Company

Major Bramley tells me that he had become concerned about developments which made long straw scarcer and dearer, and it was this which led him to think out the alternative. In the ultimate, he designed this foam bed for the cows of polyurethane, covered with a sort of envelope of PVC. The beds are in the sheds where the cows are tied separately, and they are 5½ft. by 3½ft., tapering in thickness from 3in. to 1½in. There is also, he tells me, a baby size for calves! It must be emphasized that this is a deadly serious matter which has led the major and, I gather, one or two of his friends to establish a company known as Farm Plastics Ltd. to deal entirely in plastics for agricultural purposes, and it flourishes, after four years of organization, but I must confess that there is a human, or should I say bovine, aspect to the matter which is not without a certain amount of diversion. Nobody on earth knew when the experiment was first tried out, how Bess and Maud and all their other 50 odd sisters would react. In fact, Major Bramley and his friends need have had no qualms.

'When I put the first mattresses down,' he told me, 'several cows lay on them right away.' But one might well ask why not, when they were exchanging the luxury of polyurethane foam for prickly straw! But apparently it was not entirely plain sailing. 'There was an awkward squad,' added Major Bramley, 'but they soon fell in. If you adopt Army methods with cows—regular routine and the same thing at the same time each day—you can get them to do almost anything.'

After more than 30 years' experience in both branches of the Service, Major Bramley should know!

Improved lighting, cleanliness and heating economy are combined in a single system which has just been introduced into this country from the Continent. Known as the ISORA illuminated ceiling, this product consists essentially of 39-in. square panels over which is stretched a specially formulated 'Craylene' PVC film, a product of Greenwich Plastics Ltd. The panels, which are very easily taken down for cleaning, fit into a light steel framework

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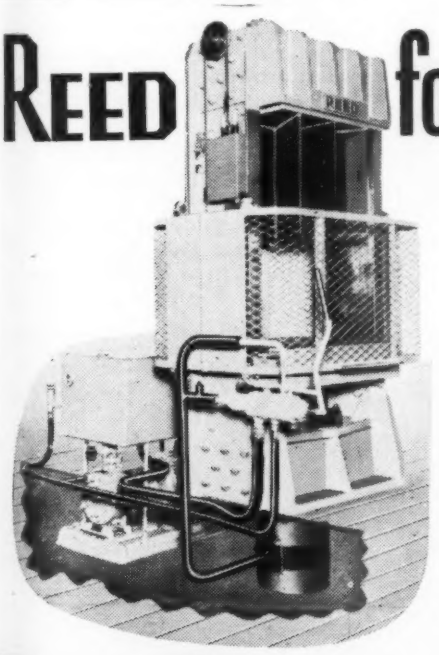

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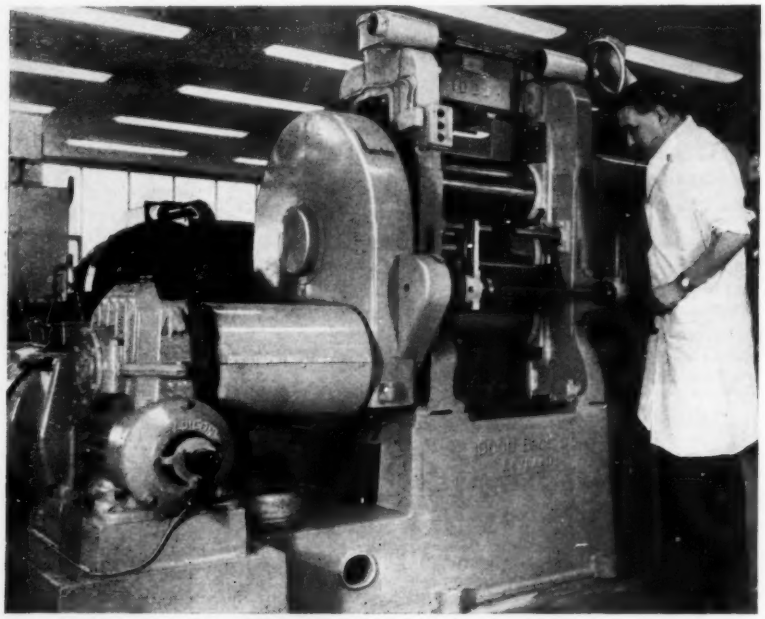
Du Pont UK Laboratory

RESEARCH AND TECHNICAL SERVICE

THE new research laboratory of the Du Pont Co. (United Kingdom), Ltd. was opened at Hemel Hempstead on May 6. To be known as the Elastomers Research Laboratory, it is the first permanent facility to be completed in Europe by Du Pont. As previously announced in RJIP, Mr W. P. Fletcher is manager.

The main concern of the laboratory, which has 10,000 sq. ft. of floor space and stands on a five-acre site, is to undertake research into the development of improved finished products using neoprene, Hypalon and Viton and the Company's rubber chemicals, and to provide technical service. In addition, practical evaluations will be made of finished products under actual or simulated service conditions.



Equipment in Du Pont's new Elastomers Research Laboratory at Hemel Hempstead includes this calendering machine, which turns out sheets of synthetic rubber of uniform thickness

The laboratory is divided into three main sections and in each the equipment is impressive, comprising as it does instruments and testing devices from a number of countries. Included in the dry processing area are mills of various sizes, a Shaw 13 x 6in., an Iddon 18 x 9in., each with two friction ratios, and an 18 x 9in. three-roll variable speed calender, also by Iddon. An interesting piece of equipment is a high pressure wire vulcanizing unit which simulates continuous vulcanization conditions used in the wire and cable industry. It consists of a steam chamber for vulcanizing at steam pressures of 100 to 275lb. per square inch and a water chamber for cooling at the same pressures. A 2in. variable speed extruder, used as well, of course, for other purposes, covers the wire samples and is followed by a cooling trough and dual capstan. Other equipment includes a Banbury 3-speed mixer; Mooney viscometer; Wallace rapid plastimeter; presses and pan vulcanizer.

The physical testing area is completely equipped to run not only the usual but also highly specialized tests to meet government and industry specifications. An interesting point is that attention has clearly been paid to the fact that testing techniques and conditions vary in different countries; a matter of importance when it is remembered that the laboratory is intended to serve not only the UK but manufacturers in continental Europe, Asia, Australasia and Africa. Equipment in this section of the laboratory is comprehensive. Included is an Accr-O-Meter for studying stress-strain characteristics of vulcanizates over a temperature range of −57°C. to 288°C. (−70° to 550°F.). The oven room contains, besides the stainless steel ovens, a Weatherometer and oxygen pressure test apparatus. Other equipment includes a Hounsfield tensile tester, various electrical testing apparatus, torsional stiffness tester, flexometers, abraders and an ozone cabinet.

Every advantage has been taken of going into a new and specially designed building to incorporate fittings and appointments — such as lighting, air conditioning, dust collection, etc. — of the latest type and, naturally, such refinements as Hypalon floor tiling. Notable, too, is the emphasis on

This electronic testing equipment can determine almost any of the physical properties of rubber samples from tensile strength to tear resistance and adhesive strength. It is highly instrumented and operates at temperatures ranging from minus 70° to 550°F.

safety. Not only are safety devices fitted to machines but the immediate area in which they operate is in many cases floored with tile of a different colour, to indicate a danger area, than that of the rest of the floor.

The manager of the laboratory, as stated above, is W. P. Fletcher (RJIP April 18). Technical manager, Elastomers, is H. J. Lanning, B.Sc., A.R.C.S., A.R.I.C., and the main technical staff comprises P. R. Bennet, A. Fiber, J. N. Milne and J. J. Mausner. The chairman of Du Pont Co. (United Kingdom) Ltd. is David H. Conklin, O.B.E., William H. McCoy is managing director and S. W. McCune III, general sales manager.

International Plastics Exhibition

EXPANDED PLASTICS

A PAPER on 'Recent Developments in Foamed Plastics in the USA,' will be given at the International Plastics Exhibition Convention by Betty Lou Raskin, of The Johns Hopkins University, Baltimore, Maryland, USA. The purpose of this paper is to consolidate recent developments made in various phases of the foamed plastics field, with emphasis on the invention of foamed plastics smokes at the Johns Hopkins University Radiation Laboratory. The paper is divided into four parts. The first part contains a brief explanation of foamed plastics. This includes mention of methods of preparation of the different types of foamed plastics, various property differences between foams, and numerous examples of new commercial applications for foamed plastics in the United States.

The second part is devoted largely to an up-to-the-minute account of the status of rigid and flexible urethane foams, rigid polystyrene foam, and rigid and flexible vinyl foams. These three generic types of foams are the most versatile of all types of foamed plastics and they are, therefore, the ones on which most of the US research and development time and money have been spent. Polyester and polyether resins, the use of halogenated hydrocarbons as blowing agents in urethane foams, expandible polystyrene beads, and plasticizers for vinyl foams are discussed.

Part three concerns the development of foamed plastics smokes ('flokes'). These smokes, believed to be the lowest density smokes which have ever been produced, comprise one of the newest and most challenging applications for foamed plastics. It is believed that they may cause the opening of numerous new fields of investigation to both foamed plastics and to smokes. They now make possible the preparation of relatively large particle size smokes composed of spherical, cellular plastics particles having diameters of five microns or more.

These smokes have unique physical and chemical properties and slower fall-out rates than the smaller diameter particles (two microns or less) found in the conventional non-plastics smokes. A method of preparing foamed plastics smokes is explained and about a dozen possible commercial and research applications for them are described. Several examples are: the seeding of rain clouds, the warming of crops, outer space tracers, and insecticide carriers. The final part of the paper contains some suggestions for future investigations in foamed plastics research.

Expanded Polystyrene

'Expanded Polystyrene: Influence of Bulk Density Upon Physical Properties,' will be discussed by W. B. Brown, of Monsanto Chemicals Ltd., Fulmer, Bucks. Expanded polystyrene can be produced in a wide range of bulk densities, about 1lb./ft.^{3} being the minimum achievable under manufacturing conditions. The physical properties of the very low density expanded material are, in the main, acceptable for general purpose thermal insulation in the building and refrigeration industries; they can, however, be altered considerably by increasing the density of the material which is then capable of withstanding relatively high stresses, etc.

This paper indicates the relationship between the bulk density of the foam and the tensile, compression, impact and flexural strengths. Other factors such as variation of loading speed and hysteresis under load, together with creep and indentation will also be considered as they are affected by bulk density. Thermal conductivities over the density range are included.

IRI Australian Section

The New South Wales Branch of the Institution of the Rubber Industry has now over 100 members and meetings are being held regularly each month, the Institution reports. A visit to CSR Chemicals Pty. Ltd., a subsidiary of the Australian company Colonial Sugar Refining Co. Ltd., was made by 50 members on March 12 last. The April meeting took the form of a symposium on 'Rubber in Footwear.' Mr A. Robinson, head of the School of Footwear, Sydney Technical College, was chairman of the panel and he was assisted by Mr H. C. Cushnie and Mr K. Freeburn. Mr Robinson gave an introductory lecture on the place of rubber in footwear, Mr Cushnie spoke on the non-leather components of modern footwear and Mr Freeburn on the subject of adhesives.

Twenty-five-year-old Mrs Barbara Kendrick, of High Wycombe, Bucks, has won the Goodyear 'Golden Girl' title in a beauty competition run through 'Goodyear Gazette,' the company's quarterly journal for the boot and shoe retail and repair trade. Mrs Kendrick's success in the contest won her a record player, which was presented to her by Mr F. E. J. Hunt, Goodyear Shoe Products Division Manager

DSIR Annual Report

THE report of the Council for Scientific and Industrial Research for 1958 was published on May 6. At a Press conference, Sir Harry Jephcott, chairman of the Research Council, said that in their second year of office—the period under review—they were taking action on what they had found out as a result of a thorough survey of many aspects of the Department's work. He went on: 'We have reached a much clearer picture of the way in which the Department should go. One of the main things we discovered was that the amount of money spent on research at Universities was not adequate, and we decided to increase our grants for special researches. The amount has already been increased and by the end of the second five-year plan there will be a really worthwhile effort.'

Second Five-year Plan

The most interesting aspect of the report was the planning for the second five-year plan. DSIR was exceptionally fortunate in being permitted to budget for a five-year period. It was a very valuable arrangement and almost essential to Council's task. Sir Harry emphasized, however, that they were keeping the plan flexible. 'We must keep flexible. World conditions are changing rapidly and the Department must be ready to help in changing them—ready to experiment with new ideas and to alter its policy and organization as the need arises.' He recalled that last year the Council had said that the research effort must be increased and the Department had a large part to play. 'You will notice that the Government has acted on this recommendation of ours,' he said. 'Whereas the Department received £36 million over the last five-year plan, we shall receive £61 million over the second five-year plan. This is a handsome increase, although, of course, one can never be satisfied where research is concerned.'

He then dealt with criticisms of the Research Associations. When the Research Council said that they would report on the Research Association movement this was assumed in some quarters to imply that the Council thought that things were seriously wrong with the movement. The Industrial Grants Committee had now carried out an extensive investigation of the movement and of its value to the country as a whole. 'I will leave you to read the report,' said Sir Harry, 'so that you can realize the strength of our feeling that the Research Association movement is of very great value to the country as a whole and to the particular industries with which it deals.'

On grants for special researches, he said: 'The grants for special researches at universities are being greatly increased. There are a number of reasons for this, but one of the most important ones is that as universities expand and the number of students and post-graduate students who are taking scientific and technological subjects increases, so it is necessary for the research staff of the universities to expand also. Taken as a whole, contributions to the universities are not a large proportion of the total budget of the Department. Even at the end of the second five-year plan they will account for only about 10% of the total expenditure.'

Copies of the DSIR Annual Report for the year 1958 can be obtained from HMSO, price 3s. 6d. net.

Dunlop Use More SR

The Dunlop Rubber Co. Ltd. may increase their use of synthetic rubbers from the present approximate figure of 33% to 40% or more in the near future according to a statement by Mr G. E. Beharrell, chairman, at a Press conference last week. He added that the development of newer synthetics might well mean still further increases in their use.

At the same time, Mr Beharrell said that the Company's new rubber estates in Nigeria were coming on well and that high yields, of the order of 1,500lb. an acre and more, were anticipated.

The 60th annual general meeting of the Company will be held at the Piccadilly Hotel, London, on June 8 at noon. Further details of results appear under 'Companies in the News' in this issue.

DUSSELDORF PLASTICS CONVENTIONS

An 'International Symposium on Ageing of Plastics' will take place in Düsseldorf on Monday October 19 1959. It will be held under the auspices of the Plastics and High Polymers Division, Section of Applied Chemistry of the International Union of Pure and Applied Chemistry (IUPAC).

On Tuesday October 20 and Wednesday October 21 1959, the 8th German Plastics Convention will be held in Düsseldorf. It is being sponsored jointly by all the plastics associations in the German Federal Republic.

The general preparatory work for both conventions is in the hands of a joint organizing committee under the chairmanship of Dr W. Mauss, Wiesbaden, president of the Arbeitsgemeinschaft Deutsche Kunststoff-Industrie, Frankfurt-am-Main. Correspondence should be addressed to the Arbeitsgemeinschaft Deutsche Kunststoff-Industrie, Frankfurt/Main, Karlstrabe 21.

ISR Sales Appointment

Mr Mat Simpson and Mr David Brooke-Boulton have been appointed area sales representatives of the International Synthetic Rubber Co. Ltd. Mr Simpson, aged 27, the Northern area sales representative, was for a number of years the chief chemist of Aerialite Ltd. Mr Brooke-Boulton, aged 29, who joined the company in March of this year after working for six years in the laboratory and sales department of Revertex Ltd., has been appointed southern area sales representative.

Morrison M. Bump has been named director of marketing for United Carbon Co. and vice-president of its subsidiary, United Carbon Company Inc., according to R. W. French, president.

The Plastics Division of Universal Metal Products Ltd. (UMP) are currently moulding the agitator for the new Parnall power washer in a phenolic material. Illustrated (*left*), is the agitator and two gear case cowls, made in cream high - impact polystyrene. Nylon wringer bearings (not shown) are also incorporated in the washer

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The ANALYSIS of RUBBER AND RUBBER-LIKE POLYMERS

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R.A.B.R.M. MANUAL No. 3

By WILLIAM C. WAKE
M.Sc., Ph.D.(Lond.), F.R.I.C., F.I.R.I.
HEAD of CHEMISTRY DIVISION
RESEARCH ASSOCIATION of BRITISH RUBBER MANUFACTURERS

THE first modern work devoted solely to this important subject to be published in the English language. In addition to the analysis of natural and synthetic rubbers, the author deals with rubber-like plastics such as Polyethylene, PVC, PVDC, PVA and Urethanes. Also discussed are the identification of compounding ingredients used in the manufacture of rubber and rubber-like polymers.

It will unquestionably become a standard work and is a "must" for all analysts interested in this subject.

CONTENTS:

Extraction Procedures - Qualitative Analysis for Polymer Type - Elemental Analysis of Extracted Polymer - Direct Determination by Functional Group Analysis - Solution and Dissolution Methods - Quantitative Cracking and Distillation Methods - Carbon Black in Rubber - Ashing, Wet and Dry, and the Determination of Trace Metals - Analysis of Extracts and Blooms - Statistical Aspects of Analytical Work.

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BTR Long Service Awards

Mr A. R. Callan of Palmer Aero Products Ltd. receiving his 50-year badge and certificate and a gift of £50 from Sir Graham Hayman, Chairman of BTR Industries Ltd. Mr Callan responded to Sir Graham's speech on behalf of the awards recipients

At a pleasant ceremony at St. Ermins Hotel, London, S.W.1, on April 27, Sir Graham Hayman, chairman of the BTR group of companies, presented awards to long-service staff of the group. These awards were: for 50 years service, £50 (free of tax) and a 50 year badge; for 40 years, a 40 year badge; for 30 years, a gold watch and a 30 year badge; and for 20 years, a 20 year badge. After a short address, which was responded to by Mr A. R. Callan, of Palmer Aero Products, Ltd., one of the recipients, Sir Graham made the presentations, details of which are as follows:—

For 50 years: R. J. Cantwell (Palmer Aero Products Ltd.), G. Bissett (A. G. Spalding and Bros. Ltd.), J. C. Smith (AGS), A. R. Callan (PAP).

For 40 years: Mrs E. Lawer (AGS), A. W. Aldridge (AGS), Miss L. Rooke (AGS), H. Wilton (AGS).

For 30 years: A. H. Brunsden (AGS), P. C. Evans (Silvertown Rubber Co. Ltd.), G. T. Burton (AGS), Miss L. C. Dowden (AGS), J. C. Knott (AGS), L. C. Lawrence (SR), R. H. Wilson (BTR), C. J. W. Copp (BTR), A. H. Snowsill (AGS), J. A. Hardman (BTR), Miss F. M. Moore (BTR), H. A. J. Green (AGS), R. E. Meller (BTR), E. A. E. Eves (BTR), E. A. Dubbin (AGS).

For 20 years: G. Sturman (PAP), P. R. McDermott (BTR), W. G. Woods (BTR), B. G. Brownlie (BTR), D. Rackley (British Moulded Hose Co. Ltd.), R. Hood (PAP), W. A. Smith (BTR), K. H. Gwyther (PAP).

Laminated Plastic Sheeting

DRAWBACK OF DUTY

THE Board of Trade give notice that they have under consideration an application for the allowance of drawback of duty in respect of the undermentioned imported material when used in the manufacture of the export goods described:

Imported Material: Laminated plastic sheeting $\frac{1}{16}$ or $\frac{1}{32}$in. thick.

Export Goods: Incombustible asbestos lime silica panels, with the laminated plastic sheeting bonded to one or both sides.

Representations which interested parties may wish to make should be addressed in writing to the Board of Trade, Tariff Division, Horse Guards Avenue, London, S.W.1, not later than June 5 1959.

Rubber Crop Returns

SHARPE, ESTALL AND CO. LTD.

	March 1959 lb.		Fin. year to date lb.		Fin. year ends
Anglo-Johore	58,200	(55,200)	491,100	(404,660)	July
Batang	69,990	(68,000)	995,486	(847,000)	March
Bekoh	167,000	(167,000)	2,386,000	(2,025,000)	March
KPRP	54,600	(46,700)	651,800	(552,000)	March
Rim (Malacca)	184,000	(153,000)	1,989,500	(1,613,200)	June
Sittang Valley	126,120	(120,650)	1,012,810	(1,139,980)	June
Kurunegala Rubber	20,310	(27,165)	70,265	(90,795)	Dec.

	March 1959 lb.		Fin. year to date lb.	
Highlands and Lowlands Para	1,278	(1,255)	4,198	(3,937)

	March 1959 lb.		Fin. year to March lb.	
Sungei-Timah	35,000*	(39,500)	721,347†	(761,400)

*Not including Melintang Estate. †Melintang 10 months included.

	March, 1959 lb.		Fin. year to date lb.	
Beau Sejour	32,200	(32,755)	510,481	(484,028)

	April 1959 lb.		Fin. year to date lb.	
Ceylon (Para)	96,705	(103,824)	510,287	(491,008)

	April 1959 lb.		No. of mths. of year to date	Fin. year fin. to date lb.	
Kemasul	37,000	(33,900)	4	154,100	(155,050)
Inch Kenneth Kajang	148,000	(143,000)	4	589,000	(641,000)

	April 1959 lb.		Fin. year to Dec. 31 1958 lb.	
Batu Tiga	139,500	(224,000)	2,917,000	

	April 1959 lb.		No. of mths. of year to date	Fin. year fin. to date lb.	
Scottish Malayan Estates	320,000	(299,100)	4	1,362,300	(1,422,100)

Companies in the News

Francis Shaw

Francis Shaw and Co. Ltd. is effectively raising its payment from the equivalent of 15% to 17½% on capital doubled by a scrip issue. There is a 10% final for 1958, and a 2½% special interim for 1959. Group profits, before tax, declined from £393,098 to £295,678. The reduction in trading profit, it is stated, is due largely to expenses incurred in expanding production and the consequent increase in work-in-progress, the level of increased production being achieved in the fourth quarter and maintained since. There is to be an extraordinary meeting to increase the authorized ordinary capital from £400,000 to £800,000.

United Sua Betong

The planted acreage of rubber of the United Sua Betong Rubber Estates at December 31 1958 was 37,461 acres, an increase of 604 acres. A further 568 acres will be cleared and planted in 1959, the directors state. Replanting in 1958 totalled 1,049 acres and 500 acres of young rubber were brought into tapping. The net profit is £413,055 (£509,236), the dividend is maintained at 50%, and a one-for-three scrip issue is proposed.

Dunlop Group

The Group net balance from trading for 1958 was £19.76m. (1957, £19.86m.) and net profit before taxation, £12.16m. against £12.48m. for 1957. Total sales of the group increased 5% to £243m. while the overall volume of sales, taking into account changing price levels, was 7% higher than in 1957.

The overseas activities of the Group have shown a profit slightly higher than that for 1957 despite difficult economic conditions in certain countries. With turnover 4% higher than in 1957, overseas earnings have again contributed the greater part of the profit.

The total Group expenditure on research and development was £2.4m. in 1958 (1957, £2.1m.). This expenditure has been charged against profits.

During the year, capital expenditure totalled £13m. of which £9m. (£5.6m.) was spent by overseas companies and £4m. (£3.5m.) by UK companies and divisions. Group fixed assets increased from £47.5m. to £54m. The greater part of this rise represents expenditure on buildings and plant for new factories being established in France, India and Rhodesia, and on new rubber estates in Nigeria, and includes the assets of the John Bull Group acquired during the year.

Available net profit of the Dunlop Rubber Co. Ltd., after retention by subsidiaries of £1.19m., is £3.57m. as against £3.02m. in 1957.

Group net profits, after £211,000 (£260,000) for the estimated increased cost of replacement of fixed assets in the UK, rose from £5,025,605 to £5,797,515, and the dividend is raised 2½% to 16½% with the one-for-four scrip issue previously announced.

P. B. Cow and Co.

In the course of his speech at the annual general meeting of P. B. Cow and Co. Ltd., the chairman, Mr Denzie H. Carlisle said that in the parent company turnover in 1958 was some 3% greater in total, but the profit earned was a little lower than in the previous year. Sales of consumer goods showed a small and easily understandable reduction but industrial sales had a 9% increase while trade with Government Departments plus various oddments was up by some 37%. Sales of liferafts manufactured by Elliot Equipment had been disappointing but since the turn of the year they had taken a number of satisfactory orders, mainly for export, and he would like to thank their selling agents, Cory Brothers, for having very considerably widened this field. They had with Cory Brothers and an American company, formed an American subsidiary for rafts.

Elliot's subsidiary, ASRAM, continued to give valuable maintenance and repair service to our customers at a small profit. The only other member of the Group to make a loss was Industrial Insulations, which manufactures adhesive tapes. The loss was small and there are now indications that it may be entering the profit earning stage in a minor way. Sorbo and Acme Stampings each finished the year with a lower profit figure than for 1957 but in the former case we feel that our new synthetic foam, with improved techniques, will bring home the bacon. So far as Acme is concerned, we are engaged in very greatly enlarging the scope of our output with, we anticipate, increased turnover and hence profit. Hertfordshire Rubber remains the brightest jewel in the crown and continues to maintain its highly satisfactory level of performance. London Moulders had an extremely good year and Peradin also makes a steady and improving contribution to your profits. Our newest subsidiary is P. B. Cow (Slough) which is now in its third year of life. We are particularly satisfied with this situation since our very large factory on the Slough Trading Estate has shown marked improvement since we turned it into a separate entity and I am glad to report that for 1958 we made a good profit. Prospects of expansion are such that we have taken the lease of an adjacent factory. Our Australian company, Leggett Rubber Industries, which is not a wholly owned subsidiary, had a good year's trading. Some of you may have been interested to see photographs of and to read about a flexible oil barge known as a 'dracone.'

I have remarked on previous occasions that the variations in the price of raw rubber are one of our headaches and this is one factor over which we have no control. The steady increase of that price during the current year should be reflected in higher selling prices and if these are not obtained there must be an adverse effect on our results. Proposed final dividend on the Ordinary stock of 7½%, making 12½%, less tax for the year, was approved.

Sussex Rubber

In his statement to be delivered at the annual general meeting on May 20, Mr Claude I. Steen, chairman, said that conditions continued to be difficult during 1958, but it was some measure of their success in these efforts that the company had managed to achieve a turnover only a little below last year's figures.

The profit on trading after providing for all charges except taxation was £35,346, compared with £11,116 in 1957, an increase of £24,230. The net profit after providing £20,465 for taxation was £14,881, compared with £4,390 in 1957, an increase of £10,491.

The board recommended the payment of a dividend of 6% less tax, absorbing £5,522.

Sir William Sinclair, director, Dunlop Rubber Co. (Scotland) Ltd., who retires on January 31 1960, will relinquish his executive duties at the end of this year. Sir William is to be succeeded by a fellow Scot, Mr Denis Hays, at present sales manager of the General Sales Division, Fort Dunlop.

Non-flammable 'Cobex,' manufactured by BX Plastics Ltd., and reinforced with expanded metal, has been used to make two fume cupboards recently installed by Tanks and Linings Ltd. for the Ever Ready Co. Ltd. and the Washington Chemical Co. Ltd. Both cupboards are completely made from 'Cobex,' including the angle framing and ducting which house the extractor fans, so making the whole installation corrosive resistant

Rubber Statistics

MALAYA — BRAZIL — BELGIAN CONGO

DETAILS of Malaya's ocean shipments and imports have now been issued by Malaya House. The following tables, which are expressed in long tons, summarize the information issued:—

Ocean shipments to:	Sheet and Crepe	Latex
UK	9,604	2,632
US	10,415	2,670
South Africa ..	1,561	185
Canada	2,759	—
Australia	2,548	413
France	6,951	622
Western Germany	5,821	1,369
Italy	3,146	531
Netherlands ..	1,170	39
Poland	4,150	360
Spain	1,068	80
Sweden	2,074	46
USSR	20,810	—
Argentina	1,542	21
Brazil	1,125	41
Japan	8,678	1,059
Others	6,599	509
	90,021	10,577

Imports from:	Total
Indonesia—Sumatra ..	17,173
Borneo ..	5,884
Remainder ..	2,246
British Borneo	3,496
Thailand	3,237
Others	411
	32,447

Compared with the total for the previous month, ocean shipments during March were at a high level, exceeding the February total by some 7,000 tons. Shipments to the United Kingdom were up by about 1,000 tons while those to the United States were some 700 tons higher. Shipments to Western Germany were 3,000 tons higher and those to Japan 2,000 tons higher. Once again shipments to the Soviet Union were on a particularly large scale, though they were about 1,500 tons below the level of the previous month, once again, however, constituting this market the most important outlet for Malaya's rubber during the month. Up to the end of March, ocean shipments had totalled 292,109 tons compared with the 1958 total for the first quarter of 265,074 tons, representing an increase of rather more than 10%.

Imports were also up on the previous month's total, amounting to 32,447 tons as against 29,854 tons. The main cause of this increase lay in increased imports from Sumatra, these having risen from 14,242 tons to 17,173 tons. Imports during the first quarter of the year amounted to 93,833 tons compared with the 1958 figure of 97,372 tons, a fall of somewhat less than 5%.

Stocks of rubber held in Singapore at the end of March rose slightly from the January (37,855 tons) and February (39,593 tons) levels, to 40,493 tons. This figure was made up of dealers' stocks (32,466 tons), port stocks (7,997 tons) and estate stocks of 30 tons. In addition, 1,195 tons of rubber were in course of foreign transhipment. In the case of the Federation, stocks at the end of February stood at 119,054 tons, some 6,000 tons less than at the beginning of the month. Of this total, 15,585 tons were held on estates, 85,088 tons were in the hands of dealers, and 18,381 tons were in the port.

Brazil

The latest statistics issued by the Comissao Executiva de Defesa da Borracha cover the last quarter of last year. They show that stocks of rubber on hand at the close of the year had fallen to 2,910 tons, this total being made up of 1,124 tons held in producing areas, 150 tons in consuming centres, and 1,637 tons held in transit; in particular, stocks in consuming centres had fallen during the quarter from 2,248 tons, being thus exactly halved. Stocks of rubber held by tyre factories fell from the October figure of 1,559 tons to 654 tons at the end of December.

Natural rubber consumption during the last quarter of the year amounted to 9,502 tons of crude, and 328 tons of latex, giving consumption totals for the year of 42,147 tons in the case of crude, and 1,199 tons in the case of latex, or 43,346 tons in all, the previous year's figure having been 38,491 tons. Consumption of synthetic rubber, both solid and latex, during the last quarter of the year amounted to 430 tons, to give a total for the whole year of 1,808 tons, compared with the 1957 total of 809 tons. Consumption of reclaim rubber during the fourth quarter (1,907 tons), brought the year's total to 8,336 tons, the 1957 total having been 6,369 tons.

Sole Crepe Exports

According to the Secretariat of the International Rubber Study Group, exports of sole crepe from Malaya during February amounted to 511 tons, making a total of 1,152 tons for the first two months of the year, the comparable 1958 total having been 1,930 tons. The United Kingdom took 224 tons of the total amount, while France took 48 tons, and Hongkong 52 tons. None of this rubber went to the United States.

Belgian Congo

Exports of rubber from the Belgian Congo during the last quarter of 1958 are quoted by the Study Group as 10,109 tons, bringing the total for the twelve months to 34,526 tons. During 1957, exports from this country amounted to 33,763 tons. Of the 1958 total, 11,285 tons were taken by Belgium, while 9,261 tons went to the United States. A further 2,433 tons went to the United Kingdom, 4,713 tons to France, 2,154 tons to Western Germany, and 2,484 tons to the Netherlands. Other countries to take rubber from this course included Denmark, Italy, Mexico, Poland, Sweden and Yugoslavia.

Export Opportunities

Polythene Sheets for the US

Mr George S. Jackson, manager, building materials department, Moore-Handley Hardware Co. Inc., 27 S. 20th Street, Birmingham, Alabama, has told the British Consulate at Atlanta that his firm are interested in importing polythene sheets. They require this sheeting in .004in. and .006in. thickness and in widths from 3ft. to 40ft. in both black and clear. They normally purchase it in 100ft. rolls, individually carton-packed regardless of the width, and could buy 1m. sq. ft. at a time, but would prefer to buy approximately 500,000 sq. ft. if shipments are fairly certain. They prefer to deal directly with the manufacturer rather than an importer.

Moore-Handley Hardware Co. Inc. are one of the leading wholesale hardware firms in the Southern States. They are considered to be a suitable connexion for UK firms. Manufacturers interested in this enquiry should write by air mail direct to Mr Jackson. It is important that quotations should show both fob and cif prices in US currency. Responding firms should copy their initial correspondence to the British Consulate, Commercial Section, 422 Hurt Building, Atlanta 3, Georgia, so that the enquiry may be pursued. B.o.T. reference: ESB/8347/59.

The address of the Export Services Branch of the Board of Trade is Lacon House, Theobalds Road, London, W.C.1. Telephone number: Chancery 4411, extensions 776 or 866.

A new range of industrial gloves—specially designed for use in contact with oils and solvents—has just been introduced by the Dunlop Rubber Co. Ltd., Cambridge Street, Manchester. Made with Hycar synthetic rubber, from British Geon Ltd., Devonshire House, Piccadilly, London, W.1, these gloves are unaffected by oils, petrol, animal and vegetable fats, alcohols and many common solvents

PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 3s. 6d. per copy (including postage).

Resin Compositions

No. 808,953. Dunlop Rubber Co. Ltd. Inventors: W. H. Hogg and W. Mobberley. Application, October 14 1954. Filed, September 23 1955. Published, February 11 1959.

A thermosetting composition comprises essentially PVC or a vinyl chloride copolymer and an amide having more than one primary or secondary amido group in the molecule. The amide is a reaction product of an unsaturated dibasic aliphatic carboxylic acid with ammonia or an amine and is used in a proportion between 1% and 15% on the PVC. In the examples, the amide is a polyamide resin derived from dilinoleic acid and ethylene diamine. In many cases the compositions contain a plasticizer, but in certain cases, no plasticizer is required. Plasticizers of the ordinary kind may be replaced partly or wholly by a synthetic rubber.

The compositions may be in the form of plastisols, doughs or solutions in organic solvents. They may be used for the manufacture of belting and proofed fabrics as well as for slush-moulded, dipped or press-moulded articles. They may be extruded while cellular products may be made by incorporating blowing agents in the compositions.

Silicone Rubber

No. 809,238. Midland Silicones Ltd. Application and Filed, June 24 1957. Application in USA, August 28 1956. Published, February 18 1959.

Silicone rubber which is stable to heat and may be produced in a translucent or coloured quality is made from a heat-curable organopolysiloxane stock containing (1) silica as a filler and (2) a carboxylic acid salt of cobalt, cerium or copper, the metal being present in a proportion of 0.001 to 0.40 part per 100 parts of the organopolysiloxane. These metal salts do not cause undesired stiffening of a compounded stock during storage prior to vulcanization such as is caused by iron salts.

Plastic Articles

No. 810,041. TI (Group Services) Ltd. Inventor: J. E. Gordon. Application, December 3 1955. Filed, February 5 1957. Published, March 11 1959.

A plastic article is made by scanning a beam of electrons over a window in a container holding a liquid resin or plastic in order to set the material, the resultant solid resin or plastic being continuously drawn away from the window to produce an article. The shape of the article is dependent on the rate of withdrawal of the material and on the path of the electron beam. Tubes and strips are examples of simple plastic products which can be made, although it is possible to make an article of almost any reasonable cross-section. The process is applicable to any resin or plastic which can be obtained in a liquid form, and is solidified by the action of a beam of electrons.

Pneumatic Tyres

No. 810,014. The Goodyear Tire and Rubber Co. Application and Filed, October 22 1956. Application in USA, April 23 1956. Published, March 4 1959.

Cracking within the grooves of a tyre tread is minimized by coating the tread with an elastomeric material resistant to ozone. Suitable elastomeric materials are neoprene, Hypalon, alcohol-soluble nylon and the reaction products of aliphatic monomercaptans with polymers of conjugated diolefins. The elastomeric material is dissolved in a solvent to form a cement, and the cement is applied to the unvulcanized tyre tread soon after it has been extruded. The solvent is allowed to evaporate to give a coating about 0.001 to about 0.020in. thick. If the coating is thicker than 0.020in. excessive tread wear results. After vulcanization of the tyre, the coating covers both the raised portions of the tread and the grooves, but the coating on the raised portions is soon worn away in service to expose the more abrasion-resistant rubber of the tread.

Shorter Abstracts

Foam Rubber. 806,708. Dunlop Rubber Co. Ltd. Filed, January 15 1957.—In the manufacture of foam rubber from natural or synthetic rubber latices, the gelled foam is vulcanized by treatment with sulphur dioxide and hydrogen sulphide.

Polymerization of Ethylene. 806,904. Hercules Powder Co. Filed, September 26 1956.—A catalyst for the polymerization of ethylene at low pressures is formed by mixing (a) one or more bis (cyclopentadienyl) salts of titanium, zirconium or vanadium with (b) a metal alkyl compound of a metal of Groups IA, IIA, IIB or IIIA of the Periodic Table.

Modified Butyl Rubber. 806,905. Esso Research and Engineering Co. Filed, October 15 1956.—A vulcanizable composition comprises a mixture of (a) butyl rubber, and (b) an oily copolymer of a multi-olefin with a vinyl aromatic hydrocarbon. The compositions are particularly suitable for inner liners for tubeless tyres.

Adhesion of Rubber to Metal. 806,933. The B.F. Goodrich Co. Filed, June 20 1956.—Adhesion of natural or synthetic rubbers to metal is effected by incorporating in the rubber a partially calcined metal-organic compound, *e.g.*, partially calcined cobalt acetate. The process has particular application to bonding rubber to wire in wire-reinforced tyres.

A newly launched product in the US, the Plews 'Handy Little Greaser' *above*, is moulded of Tenite butyrate supplied by Eastman Chemicals. It delivers up to 3,000 lb. pressure per sq. in. through a 3-in. nozzle. The 'Handy Little Greaser' is available alone, or in a home kit which includes the popular Plews oiler, *below*. The oiler, also moulded of butyrate, delivers a fine, pressurized stream of oil from a long spout that can easily be aimed and fired into hard-to-get-at parts

Rubber Markets

LONDON

A further all-round fall was recorded in rubber prices during the week under influence of earlier reports that the US stockpile may be reduced. The subsequent statement in Washington that such a move could not become effective till 1961, brought a recovery in prices. The market was steady to firm and prices were, on balance, around ½d. lb. lower.

Latest prices are as follows:

No. 1 RSS Spot: 29½d.-29¼d.

Settlement House:

June 29⅝d.-29¾d.

July/September 29¾d.-30d.

October/December 29¾d.-29⅞d.

January/March 29⅜d.-29½d.

April/June 29⅜d.-29⅝d.

No. 1 RSS cif basis ports:

June 29½d.-29⅜d.

July 29⅜d.-29½d.

Godown:

June 100⅝ Straits cents nominal.

LATEX

Centrifuged latex per gallon in drums, June/July shipment, 17s. 9d. seller, cif European ports. Spot, seller, 18s. 1d. Bulk, seller, 17s. 8d. Creamed, seller, 17s. 4d. Normal, seller, 13s. 3d.

AMSTERDAM

The Amsterdam rubber market ruled as follows on May 19:

	Guilders per kilo	
	May 19	Previous
May	2.88	2.88
June	2.88	2.88
July	2.92	2.92
August	2.92	2.92
September	2.92	2.92
July/September ..	2.88	2.92
October	2.92	2.92
November	2.92	2.92

Sales: 30 Tendency: Easy

DJAKARTA

It was a quiet session with buyers rather reserved. The close was quiet.

	Rupiahs per kilo	
	May 19	Previous
Spot No. 1 Priok ..	27.00b	27.00b
Spot No. 2 Priok ..	26.00b	26.00b
Spot No. 3 Priok ..	25.50b	25.00b
No. 1 fine pale crepe	24.50b	25.00b

BANGKOK

No. 1 RSS

The price for No. 1 RSS, at Bangkok on May 18 was 33.25 US cents per lb.

CEYLON

No. 1 RSS

The price for No. 1 RSS, spot, at Colombo on May 18 was 128 (129) Ceylon cents per lb.

NEW YORK

The following prices ruled in New York on May 18:

DEALERS' PRICES

	C. & F. cents per lb.	
	May 18	Previous
No. 1 RSS, June	34⅜b–35a	35b–35¼a
July	34⅜b–35a	—
No. 2 RSS, June	34½b–34⅝a	—
July	—	—
No. 3 RSS, June	34¼b–34½a	—
July	—	—
No. 1 RSS, Spot	—	—
No. 3 amber blanket crepe, Aug.	—	—
No. 1 latex, thin crepe, June ..	—	—
No. 1 latex, thick crepe, June ..	—	—

FUTURES—REX CONTRACT

	US cents per lb.	
	Closing	Previous Close
May ..	36.25b–37.00a	35.75b–36.75a
July ..	35.90b–36.00a	35.75t
Sept. ..	35.40b–35.45a	35.31t
Nov. ..	34.80b–34.90a	34.80t
Jan. ..	34.50t	34.60b–34.70t
Mar. ..	34.30b–34.45a	34.45b–34.55a
May ..	34.20b–34.40a	34.25b–34.40a

Sales: 18 Tendency: Steadier

Rubber futures backed and filled in light dealings, and were latterly steady in the nearby positions, but otherwise modestly lower for the day. The holiday in London and a trade outing here made for quietness in the market. Physical rubber was quiet with the undertone steady.

SINGAPORE

Prices were marked down at the opening on May 18 on disappointing overseas advices and eased further on a very quiet market. There was fair interest in lower sheets but offerings were small and high priced. The afternoon session was dull with a lack of trade support. Upcountry liquidation was confined mainly to No. 1 RSS and lower sheets were still in demand for the US at narrower differentials but Continental destinations were offered more freely. After hours, the market was slightly easier.

	Straits cents per lb., fob Malayan ports to open ports	
	Close	Previous Close
No. 1 RSS, June	100¼–100½	102¼–102⅜
July	99⅞–100⅛	102 –102⅜
No. 2 RSS, June	98½–99¼	100⅜–101¼
No. 3 RSS, June	98⅛–98⅜	99⅜–100
No. 4 RSS, June	97¼–97⅜	99 – 99½
No. 5 RSS, June	96 – 96⅜	97 – 97⅛
No. 1 Spot ..	100 –100½	102 –102⅜
No. 3 blanket, thick remilled, June	95 – 97	97 – 99
No. 1 fine pale crepe, June ..	103 –105	105½–107½
2X thin brown crepe, June ..	96 – 97	97½– 98½

Tendency: Slightly easier

The Industrial Syndicate quote latex, native produce, 60% centrifugal, packed in rec. drums fob at 198.80d. per gallon.

US Tyre Exports Fall

Exports of US made rubber tyres and tubes, already hit by competition from US owned foreign manufacturing facilities, are likely to shrink further this year, according to informed trade sources. These sources, said factors in this decline, which is occurring despite world demand, include severe competition from Japan and West Germany and an estimated drop in US motor vehicle exports.

Moreover, as more and more US tyre plants are established abroad, the ratio of domestic US exports to total US output both here and abroad will probably continue to dwindle.

Mr L. C. Boos, vice-president and general manager of US Rubber Co.'s international division, predicted that 'future competition for foreign tyre and tube markets will be on the basis of local manufacturing not domestic exports.' In the last five years most categories of tyre products have shown export declines. Mr Boos pointed out that rising world motor vehicle registrations are an important factor influencing the establishment of foreign manufacturing facilities.

In 1958 motor vehicle production outside the US surpassed domestic US output for the first time. Mr Boos noted that such factors as proximity to market and areas, foreign exchange position, and local government import and economic policies also influence the decision of US firms to build tyre plants abroad. Foreign governments often protect local manufacturing facilities by restricting import to tyre sizes not made locally.

Nigerian Rubber Exports

Nigerian rubber exports in January totalled 3,479 tons against 2,905 in January last year, according to statistics recently released. Main destinations during January were, in tons: United Kingdom, 1,193; West Germany, 698; United States, 643; Czechoslovakia, 305; Netherlands, 101.

Crepe exports in January totalled 1,951 tons against 1,241 in January last year. The United Kingdom was the main customer with 879 tons followed by the United States with 546 tons.

The Dunlop Rubber Company is making a donation of £10,000 to the appeal fund of the Royal College of Surgeons. The purpose of the fund is to improve the College's educational facilities.

Industry INTELLIGENCE

Technical Data

Polysar S-630

Polysar S–630 is an easy-processing hot-polymerized SBR stabilized with an improved non-staining and non-discolouring antioxidant. It has been developed to replace Polysar S–50, which is non-staining and relatively non-discolouring. Information on the properties and uses of S–630 is given in Polysar Technical Report No. 7:12A, distributed in the UK by Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

Polysar S is a staining and discolouring easy-processing SBR and comparative data are given in the report for Polysars S, S–50 and S–630. The differences between these Polysars and the cold-polymerized Polysars are not very great, but when easy-processing requirements outweigh the need for the highest tensile strength or abrasion resistance, S–630 or S should be used. Polysar S–630 is suggested for the following light-coloured or non-staining applications: white tyre sidewalls, tyre carcass stocks, belting carcass stocks, sponge goods, floor mats for cars, floor tiles, ebonite and cements. This grade of Polysar is also of special interest for incorporation in polystyrene to increase its impact resistance. Recipes are included in the report for flooring tiles based on Polysar S–630 and for passenger tyre sidewalls based on Polysar S.

Curing System for Neoprene Type W

NA–22 is a very effective accelerator for Neoprene Type W but for some stocks a greater degree of processing safety is required than is provided by this accelerator. Recent work has shown that the use of Thiuram M in combination with NA–22 provides an excellent balance between cure rate and processing safety, and the use of this curing system is discussed by R. C. Scott in Report BL–345 issued by the Elastomer Chemical Department, E. I. du Pont de Nemours and Co. (Inc.), Wilmington 98, Del., USA.

Three series of compounds were prepared, all based on Neoprene Type W. The first series contained 29 phr (20 volumes) of SRF black and 0.5 part of NA–22. Addition of 0.5 part of Thiuram M doubled the scorch resistance of the stock, yet the rate of cure as measured by modulus and compression set was of the same order as that of the original compound. Clay was used in the second series of compounds, in a proportion of 105 phr, with 1 part of NA–22. Addition of 0.5 part of Thiuram M improved the scorch resistance, but in this clay-loaded stock, MBTS rather than Thiuram M offered the better balance between processing safety and cure rate.

The third series of compounds contained 105 phr of clay and 15 phr of FEF black and were of the kind used for mechanical goods and cable sheathing. For CV curing of wire and cable, a combination of NA–22, Thionex, DOTG and sulphur is generally employed in Neoprene Type W stocks. However, the use of NA–22 and Thiuram M (1 part of each) approaches this combination in processing safety without the higher compression set of stocks containing sulphur.

Machines, Materials and Equipment

Mains Failure Alarm Bell

There are numerous electrical appliances and machines that by necessity operate continuously and cannot command the 100% attention of any operator or attendant, *e.g.* continuous processes in industry, burglar alarms, etc. A failure of mains supply if not attended to with speed can be a costly business. Londex Ltd., Anerley Works, London, S.E.20, are now producing a

mains failure alarm which consists of a clockwork bell which will ring as soon as the mains supply to the instrument is broken. The bell will ring for two minutes and is rewound simply by turning the bell dome in a clockwise direction.

The bell can be fitted with a visual device to indicate that it needs rewinding. The alarm costs £6 10s. 0d. without extras.

Air-Conditioners

Vacuum formed polystyrene components are being used extensively by Temperature Ltd., Burlington Road, London, S.W.6, in their new 'Temkon' air-conditioning units. Saroy polystyrene sheet is employed for forming these components because of its exceptional dimensional stability at the temperatures required in this type of unit. It is available in a variety of colours. The vacuum formed parts include the attractive front and grille, the condenser plenum, evaporator fan scroll and evaporator drip tray. Saroy sheet is manufactured by Saro Laminated Wood Products Ltd. using Styron 475 high impact polystyrene.

Dust Collection Plant

The SPA collector, manufactured under licence by Steels Engineering Installations Ltd., of Sunderland, one of the Steel group of companies, belong to the multi-cellular group of dry centrifugals, but depends on a unique principle of selective particle acceleration. From this principle, it is claimed, stems the following main advantages: Collection is extended to the smaller particle sizes; collector wear is eliminated; despite the high collection performance, the pressure drop and hence power consumption is low. The SPA collector comprises a number of standard elements housed within a fabricated steel body with dust collecting hopper. The number of elements is varied to meet the volume requirements of each application. There is no secondary system to effect final separation of the finer particles and requiring a secondary booster fan as is the case in many high performance collectors in this class. Separation of the entrained particles is carried out in one operation within the collector elements.

Publications Received

Price's (Bromborough) Ltd.

Towards the end of last year Price's (Bromborough) Ltd., New Ferry, near Birkenhead, announced the opening of a new soda saponification plant. The larger part of the capacity of this plant is devoted to the manufacture of products based on castor oil. The company has recently prepared literature giving information about these products and their uses. 'Technical Publication No. 3—12-Hydroxystearic Acid' deals primarily with the use of 12-hydroxystearic acid (hydrogenated castor oil fatty acids) in the preparation of multi-purpose lithium based greases but it is also of interest to manufacturers of alkyd resins. A technical bulletin sheet headed '"Prifac" Brand Castor Oil Fatty Acids' covers ricinoleic acid and castor oil fatty acids based on firsts and seconds castor oil.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

VYNALAST (783,040) For leathercloth, and materials in the nature of leathercloth made wholly or principally of plastics. By Imperial Chemical Industries Ltd., Imperial Chemical House, Millbank, London, S.W.1. To be associated with No. 731,432 (3978, 846) and another. (Class 27; April 8 1959.)

DENTRILUX (781,692) For plastics in the form of powders or pastes specially prepared for use in the manufacture of artificial teeth. By Leonard Edward James Langford trading as Langford Dental Manufacturing Co., 4 Duppas Road, Croydon, Surrey. (Class 5; April 15 1959.)

VENSEAL (770,467) For metal foil; and metal foil laminated with paper, with films of plastics or cellulose, or with combinations of paper, films of plastics and films of cellulose; all being goods externally surfaced wholly or partly with coatings of thermoplastic adhesives, all sold uncovered or covered on one or both sides with porous material and all being goods for wrapping (packaging) purposes in which the metal foil predominates; and collapsible tubes of common metal (sold empty) for use in dispensing extrudable commodities. By Venesta Ltd., Vintry House, Queen Street Place, London, E.C.4. (Class 6; April 15 1959.)

POLYROBE (785,639) For wrapping machines and parts thereof included in Class 7. By Smith and Nephew Plastics Ltd., Neptune Street, Hull. (Class 7; April 15 1959.)

MANUMATIC (785,978) For manually controlled hydraulically operated plastic injection moulding machines. By O. Florin Ltd., 88/89 Holloway Road, London, N.7. (Class 7; April 15 1959.)

BELFLEX (775,941) For electrical insulation materials made of coated textile piece goods or of flexible plastics in sheet form. By Belstaff Manufacturing Co. Ltd., 5 Caroline Street, Longton, Stoke-on-Trent, Staffordshire. (Class 7; April 15 1959.)

MELFLEX (776,081) For plastics included in Class 17 in the form of sheets and of films, none being rigid. By The Metropolitan Leather Co. Ltd., Terminal House, Grosvenor Gardens, London, S.W.1. (Class 17; April 15 1959.)

SCIENTEX (780,232) For sheet material made of plastics and included in Class 17. By British Scientex Ltd., 31-32 King Street, Covent Garden, London, W.C.2. (Class 17; April 15 1959.)

KENTREDDER (784,109) For rubber, and artificial rubber; and articles included in Class 17 made therefrom. By Channel Islands Tyre Co. Ltd., 32/33 The Parade, St. Helier, Jersey, Channel Islands. Address for service is c/o Carpmaels and Ransford, 24 Southampton Buildings, Chancery Lane, London, W.C.2. (Class 17; April 15 1959.)

FEDOTHENE (785,067) For flexible tubing of polythene plastics for use in watering plants by sprinkling. By British Cellophane Ltd., Bath Road, Bridgwater, Somerset. (Class 17; April 15 1959.)

UNIROVE (783,260) For sheets, rods, tubes and shaped sections, all made of glass fibres and included in Class 21. By Ferro Enamels Ltd., Ounsdale Road, Wombourn, Wolverhampton, Staffordshire. (Class 21; April 15 1959.)

UNIFAB (783,261) For sheets, rods, tubes and shaped sections, all made of glass fibres and included in Class 21. By Ferro Enamels Ltd., Ounsdale Road, Wombourn, Wolverhampton, Staffordshire. (Class 19; April 15 1959.)

UNIFORMAT (783,259) For sheets, rods, tubes and shaped sections, all made of glass fibres and included in Class 21. By Ferro Enamels Ltd., Ounsdale Road, Wombourn, Wolverhampton, Staffordshire. (Class 21; April 15 1959.)

The Goodyear Tyre and Rubber Co. (Gt. Britain) Ltd., Wolverhampton, have introduced a new scooter tyre. Replacing the 'notch rib' pattern, the new tyre is the Goodyear 'block rib,' and is the special scooter version of the famous Goodyear Grasshopper motor-cycle tyre. The tread consists of tough, spear-shaped tread blocks that will grip on any surface—wet or dry. Self-cleaning and longer wearing, the new tyre is built to stand up to the toughest treatment on or off the road. This latest addition to the Goodyear range is the result of specialized painstaking research. It embodies all the features the rider needs, for top reliability and safety to an economical price

PATENT LIST

Printed copies of the Specifications in the following list can be obtained from the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d., including postage, but about six weeks after the date of this publication will usually elapse before they come available. Orders with remittance may be sent in advance to the Patent Office, and will be fulfilled immediately the Specifications are published.

COMPLETE SPECIFICATIONS ACCEPTED

Open to public inspection on May 13 1959

Firestone Tire and Rubber Co. Tubeless tyre rim and valve. 813,327.

Eastman Kodak Co. Products of polymeric compounds by the polymerization of 8 olefins. 813,291.

Farbenfabriken Bayer A.G. Process for dehydrating ethylene diamine. 813,429.

Koppers Co. Inc. Ethylene polymerization process. 813,221.

Standard Telephones and Cables Ltd. Manufacture of strip from plastic material. 813,225.

J. H. Fuchs. Method of producing castings in injection moulding and die-casting machines and apparatus for performing same. 813,232.

F. Weiss. Shaft sealing ring of rubber or the like. 813,370.

G. H. Kins. Sink unit of synthetic plastic material. 813,169.

Open to public inspection on May 21 1959

Trylon Ltd. Moulding of polyester resins. 813,535.

Owens-Corning Fiberglas Corporation. Coated glass fibres. 813,601.

Farbwerke Hoechst Aktien-Gesellschaft Vorm. Meister, Lucius, and Brüning. Process for the manufacture of sheets of polymers of olefinic compounds free from plasticizers. 813,570.

Celanese Corporation of America. Hardening of cellulose acetate precipitates. 813,625.

Kodak Ltd. Photographic materials and in light-sensitive polymeric compounds therefor. 813,604.

Kodak Ltd. Photographic materials and in light-sensitive polymeric compounds therefor. 813,605.

Imperial Chemical Industries Ltd. Solvents for natural resins. 813,807.

British Insulated Callender's Cables Ltd. Apparatus for the vulcanization of rubber covered wire and cable. 813,699.

Imperial Chemical Industries Ltd. Polymerization of unsaturated hydrocarbons. 813,793.

Celanese Corporation of America. Cellulose ester materials. 813,516.

Badische Anilin- and Soda-Fabrik A.G. Aqueous dispersions of polymerization products of ethylene. 813,814.

Courtaulds Ltd. Production of polyacrylonitrile threads, fibres, filaments and the like. 813,815.

Soc. des Usines Chimiques Rhone-Poulenc. Polymerization of ethylene. 813,797.

NEW COMPANIES

R. H. Meeson Ltd. (622,945).—Capital: £10,000 in 7,500 ordinary and 2,500 10% redeemable cumulative preference shares of £1 each. To carry on the business of factors, brokers, mercantile agents, and general agents for all kinds of work; dealers in materials used in the manufacture of footwear and its accessories, textiles, leather, brocades, plastics, fabrics and rubber, etc. Regd. office: 45 Ludgate Hill, London, E.C.4.

Fibra Cars Ltd. (622,766). — March 10: Capital: £100 in £1 shares. To carry on the business of plastics moulding, etc. The directors are: Edward C. Davey, 67 Egley Road, Woking; John S. P. Davey, 10 Cherry Street, Woking (directors of Abbott Equipment Ltd., etc.); Ronald J. T. Mingay and Charles C. Hookey. Regd. office: 65 Egley Road, Woking.

Ehen Ltd. (622,763).—March 10. Capital: £1,000 in £1 shares. To carry on the business of manufacturers, agents for and wholesale and retail dealers in rubber and plastics of all kinds, rubber and plastic sheeting, tubes, tyres, macintoshes, waterproofs, etc. The permanent directors are: Charles H. Young, 17 The Green, Bransty, Whitehaven; Miss Nancy C. Metcalfe, 9 Oak Bank, Whitehaven. Regd. office: 134 Queen Street, Whitehaven.

J. D. Weaver Manufacturing Co. Ltd. (622,680).—March 10. Capital: £10,000 in £1 shares. To carry on the business of manufacturers, importers and exporters of and dealers in decorative objects, containers, ornaments, window display and publicity materials, models, toys and fancy goods, whether made of plastics or other materials, etc. The directors are Frederick Marzillier and John D. Weaver. Regd. office: 36 Southampton Street, London, W.C.2.

Studland Plastics (London) Ltd. (622,902).—March 11. Capital: £100 in £1 shares. To carry on the business of manufacturers, moulders, prefabricators, producers, exporters and importers of and dealers in plastics and plastic products, etc. The permanent directors are: Edward J. Raven and Norma Raven, both of 23 High Road, Willesden, N.W.10; Francis L. Orpin, director of Electronic and Television Industries Ltd., and Vera I. Orpin, both of 113 Studland Road, Hanwell, Mdx. Regd. office: 23 High Road, Willesden, London, N.W.10.

Kapsikak Estates Ltd. (623,746).—March 20. Capital: £100 in £1 shares. To carry on the business of planters, cultivators, developers, dealers in and managers of lands and plantations in any part of the world, etc. The directors are: Ronald Mann, Fernhurst Rise, Fernhurst, nr Haslemere, Surrey; John A. D. Finch Noyes, Hobbs Cottage, Piltdown nr. Uckfield, Sussex; Wilfred J. Rettie, M.C.; Wallace R. T. Picton-Warlow, M.B.E.; Walter J. L. Haworth, all directors of Eastern Produce and Estates Co. Ltd., etc. Regd. office: 13 Rood Lane, London, E.C.3.

Increases of Capital

Talawakelle Estates Holdings Ltd. (617,804), 13 Rood Lane, London, E.C.3.—Increased by £126,124, in 29,842 7% cumulative preference and 96,282 ordinary shares of £1 each, beyond the registered capital of £100. The company was converted into 'public' on January 1 1959. The above increase is for the purpose of acquiring the whole of the issued share capital of The Talawakelle Estates Co. Ltd.

Preston Tyre-Fabric Manufacturing Co. Ltd. (168,757), Higher Walton Mills, Preston.—Increased by £200,000 in 2s. shares, beyond the registered capital of £100,000.

Nickwood Plastics Ltd. (456,672), 20 Bloomsbury Square, London, W.C.1.—Increased by £9,000, in £1 ordinary shares, beyond the registered capital of £1,000.

Aquascutum and Associated Companies Ltd. (223,278), 100 Regent Street, W.1.—Increased by £100,000, in 1s. 'A' ordinary shares, beyond the registered capital of £500,000.

Morrison (Sheetings) Ltd. (342,317), 118 Portland Street, Manchester, 1.—Increased by £900, in £1 ordinary shares, beyond the registered capital of £100.

Atlas Plastics Ltd. (610,159), Brook Road, Wood Green, London, N.22.—Increased by £49,900, in £1 ordinary shares, beyond the registered capital of £100.

Rubber Journal and International Plastics CLASSIFIED ADVERTISEMENTS

APPOINTMENTS VACANT

6d. a word, Minimum 10/- Box 2/-

CHEMIST, preferably a graduate, required by established rubber and ebonite manufacturers in the Manchester area. The position is permanent and offers excellent prospects to a man possessing the necessary qualifications and experience, which should cover the development and production control of natural and synthetic rubbers. A knowledge of plastics is desirable. Full details of age, qualifications, experience and present salary should be submitted, in strict confidence, to:—Box 46. (46)

CHEMIST required with experience in compounding natural and synthetics and of process control. Several years' proved experience and A.I.R.I. or equivalent preferred. Details in confidence to Long and Hambly, High Wycombe. (55)

DEVELOPMENT engineer required for large rubber and plastics manufacturing company near Manchester. Candidates should have a wide experience of machinery design and plant layout. This is a good opportunity for a young engineer having suitable qualifications. Please state experience and salary required.—Box 57. (57)

EXPERIENCED sales manager required to develop sales for a new company in Norfolk, the company is to produce welded articles from P.V.C. sheeting.—Box 45. (45)

APPOINTMENTS VACANT (continued)

GEORGE ANGUS AND COMPANY LIMITED require a works manager for rubber and plastics factory in Newcastle upon Tyne. He will be responsible to the general manager for manufacture of mechanical rubber products including conveyor belting and hose and for control of 250 operatives. Applicants must have relevant experience in the rubber industry and should preferably have knowledge of P.V.C. processing. A salary of about £1,500 p.a. will be paid and there is scope for further advancement in a Group employing 2,500 people. Removal expenses will be paid and the Company operates house purchase and pension schemes. Applicants, preferably aged 30-45, should write to:—Group Appointments Officer, George Angus and Co. Ltd., P.O. Box 139, Newcastle upon Tyne. (48)

PRODUCTION engineer. Work study. An old-established and progressive private company in the London area, manufacturing rubber components and diving equipment, requires a work study engineer to assist in plans for development. He will be expected to advise the Board on methods, layout, wage structures and incentive payments based on work measurement and associated problems. Preferred age, between 28 and 35 with thorough work study experience, not necessarily in the rubber industry. The post will appeal to executives interested in future management opportunities. A four-figure salary is envisaged, depending upon the experience and calibre of the successful candidate, together with membership of a pension scheme. Replies, which will be treated in strict confidence, in writing, quoting reference IM, to:—Production-Engineering Ltd., 12 Grosvenor Place, London, S.W.1. (54)

APPOINTMENTS VACANT

(continued)

LABORATORY assistant with experience of mill mixing, physical testing and routine analysis required for development work with expanding company. Salary £500 p.a. Good conditions, 5-day week. Apply:—Secretary, The Huntingdon Rubber Co. Ltd., Ferrars Road, Huntingdon, Hunts. (47)

RUBBER technologist required, experienced in process and control of live skin sponge mouldings, motorcar windscreen extrusions and general mechanicals. Good salary, responsible position and first-class opportunity in expanding organization. Write to:—Works Manager, Long and Hambly Ltd., Great Billing, Northampton. (51)

SOUTH AFRICAN importing company, located in Durban, with expanding interests in the supply of ingredients to the rubber, plastics and allied industries has a worthwhile opening for a keen and experienced young salesman, who can furnish evidence of a sound technical training. Knowledge of dyestuffs would be an additional advantage. Applicants who should be 25-35 years of age and preferably single are invited to send full particulars to:—Box 53. (53)

THE John Bull Rubber Company invite applications from graduate chemists, physicists and engineers, who have completed National Service, for positions in their laboratories, or those of their associated companies. The successful applicants will spend their first year in the company's employ taking a full-time course at the National College of Rubber Technology leading to a diploma of the Institution of the Rubber Industry. Thereafter duties will comprise research, development and/or factory investigations. Initial salary will not be less than £600 a year, exclusive of tuition fees. Write in confidence to:—The Technical Director, The John Bull Rubber Co. Ltd., Evington Valley Mills, Leicester. (38)

WORKS Engineer required for a medium-sized factory in the Manchester area. Applicants should have a good experience of the design and installation of rubber and plastics plant and factory services. Apply in confidence stating experience, qualifications and salary required.—Box 56. (56)

YOUNG rubber technologist, age 25-30, minimum qualifications L.I.R.I., required to take charge of process control laboratory. Knowledge of compounding, physical testing for footwear components, mechanicals, rubber flooring essential. Superannuation scheme in operation. Write in confidence stating previous experience, education and salary to:—Box 58. (58)

ARTICLES FOR SALE (SECONDHAND)

6d. a word, Minimum 12/6 **Box 2/-**

EIGHT-DAYLIGHT press, platens 36in. x 30in.; ram 24in. diameter; 1-ton p.s.i. 5-Daylight press, platens 54in. x 54in.; 24in. ram; 1-ton p.s.i. Bale cutter, 6 bladed type. Murphy 36in. rubber slitting machine.—Reed Brothers (Engineering) Ltd., Replant Works, Woolwich Industrial Estate, London, S.E.18. Telephone: Woolwich 7611/6. (59)

ONE E.M.B. 9C injection moulding machine. Injection pressure 7.6-tons. Ram 1⅞in. diameter x 7¾in. stroke. Electrically heated and controlled cylinder. Manual or single cycle, or continuous automatic operation. Purchased September 1957.—Contact Mr. P. A. Rodgers, Dunlop Rubber Co. Ltd., Speke, Liverpool, 24. Telephone: Hunts Cross 1850, extension 44. (49)

PLASTICS EXTRUSION PLANT

One variable speed 1½in. plastics extruder.
Two 3-speed 1½in. plastics extruders.

All complete with electrical heating, control panels with direct reading dial thermo-couples, motors and starters. Variable speed haul-off units, water cooling tanks. Three straight die-heads, one side entry sheathing die head, all interchangeable. Buyer has option to purchase approximately 20 profile and tubing dies at concessional price.

The above comprehensive equipment is in excellent condition, ready for immediate connexion to services and becomes available due to change in policy. Can be seen running.

Total price (less dies) £2,500 ex-works.—Box 50. (50)

APPOINTMENTS WANTED

6d. a word, Minimum 10/- **Box 2/-**

RUBBER technologist (38) mechanical rubber, latex and foam. Compounding development and production. Some knowledge of plastics. Any job considered.—Box 52. (52)

BUSINESS OPPORTUNITIES

6d. a word, Minimum 12/6. **Box 2/-.**

EXECUTIVE recently returned from United States tremendously impressed by developments in rigid and flexible polyurethane foams wishes to discuss with company or responsible individual the setting up of a manufacturing organization. Top US contacts in this field and 'tie-up' with American Company possible.—Box 44. (44)

AGENCIES and REPRESENTATIVES

6d. a word, Minimum 12/6 **Box 2/-**

WITCO CHEMICAL COMPANY LIMITED require experienced representative to cover rubber trade Greater London area and South-West England. Some technical knowledge desirable. Applicants must be resident London area. Excellent prospects for right man.—Apply by letter Managing Director, Bush House, W.C.2. (43)

MISCELLANEOUS

6d. a word, Minimum 12/6 **Box 2/-**

MANUFACTURERS of roughing machines for rubber sheeting, sponge rubber, splitting machines, leather cloth plant, embossing plates and rollers, spreading machines and presses.—G. L. Murphy, Ltd., Imperial Works, Menston, Nr. Leeds. (238R)

MILLING compounding capacity available. Large or small quantities.—Fleet Rubber Products Ltd., 12-18 Fleet Road, Fleet, Hants. Fleet 1607. (40)

MOULDING capacity available. Competitive prices. Prompt delivery.—Fleet Rubber Products Ltd., 12-18 Fleet Road, Fleet, Hants. Fleet 1607. (40A)

'MOULD MAKERS' required with capacity for quick delivery, within easy reach of Advertiser's factory, in East London or South Essex.—Box 60. (60)

SCISSORS ground and set by London cutlers established over 100 years; 48 hours postal service; 1/6 per pair.—J. A. Fowler, 18/22 Bell Street, Edgware Road, London, N.W.1. PAD 1491. (74R)

SLITTING capacity available for tape production.—Phoenix Rubber Co. Ltd., 2k Buckingham Avenue, Trading Estate, Slough, Bucks. Tel. No. 22307. Grams: Phenrub, Slough. (54)

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Owing to the possibility of a dispute in the Printing Industry, will advertisers kindly co-operate by sending in their classified advertisements by first post, Tuesday morning, to ensure that they appear the same week.

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